1995

Self-Study Report 1995

Self-Study Report 1995

Conservation and Survey Division

Institute of Agriculture and Natural Resources
University of Nebraska-Lincoln

SELF-STUDY REPORT

OF THE

CONSERVATION AND SURVEY DIVISION

Institute of Agriculture and Natural Resources
University of Nebraska-Lincoln

July 1995

CONSERVATION & SURVEY DIVISION
COMPREHENSIVE REVIEW TEAM SCHEDULE

WEDNESDAY, SEPTEMBER 6

7:00 - 8:15 a.m.	Breakfast with CSD Director, IANR Vice Chancellor and Administrative Council, Vice Chancellor for Research Priscilla Grew, Dean of Arts and Sciences Brian Foster, & Dean of Engineering Jim Hendrix, East Campus Union (room to be posted)
8:30 - 9:30 a.m.	Orientation meeting with Division Administration and Self-Study Committee, CSD Conference Room
9:30 - 10:30 a.m.	Tour of CSD Facilities
10:30 - 11:15 a.m.	Review Session I - Geology Program and Participating Staff. (Presentation by *Bob Diffendal*, Geology Representative on CSD Strategic Planning Committee), CSD Seminar Room.
11:15 - 12:00 noon	Discussion Session I (Geology), CSD Seminar Room.
12:00 - 1:30 p.m.	Brown bag lunch for review team
1:30 - 2:15 p.m.	Review Session II - Water Program and Participating Staff. (Presentation by *Jerry Ayers*, Water Representative on CSD Strategic Planning Committee), CSD Seminar Room.
2:15 - 3:00 p.m.	Discussion Session II (Water), CSD Seminar Room.
3:00 - 3:30 p.m.	BREAK
3:30 - 4:15 p.m.	Review Session III - Soils Program and Participating Staff. (Presentation by *Francis Belohlavy*, Soils Representative on CSD Strategic Planning Committee), CSD Seminar Room.
4:15 - 5:00 p.m.	Discussion Session III (Soils), CSD Seminar Room.
7:00 p.m.	Review Team discussion at hotel

THURSDAY, SEPTEMBER 7

8:30 - 9:15 a.m.	Review Session IV - CALMIT Program and Participating Staff. (Presentation by *Jim Merchant*, CALMIT Representative on CSD Strategic Planning Committee), CSD Seminar Room.
9:15 - 10:00 a.m.	Discussion Session IV (CALMIT), CSD Seminar Room.
10:00 - 10:15 a.m.	BREAK

(OVER)

10:15 - 11:45 a.m.	Review Session V - CSD Support Staff
12:00 - 1:30 a.m.	Lunch with Associated Department Heads - *Doug Amadeo* (Geography), *S. Baenziger* (Agronomy), *B. Blad* (Ag. Meteorology), *E. Durrance* (Geology), *G. Hergenrader* (Forestry, Fisheries and Wildlife), *Glenn Hoffman* (Biological Systems Engineering), *Bill Kelley* (Civil Engineering), *B. Volk* (Water Center) at City Campus Union.
1:30 - 2:45 p.m.	Meeting with Representatives of Associated Federal/State/Local Agencies, CSD Seminar Room.
2:45 - 3:00 p.m.	BREAK
3:00 - 4:00 p.m.	Review Session VI - Discussion of Action Plans with (10-minute) presentations as follows and Participating Staff, CSD Seminar Room. (1) Action Plan to Accelerate and Expand Acquisition of Natural Resources Data - *Bob Diffendal* (2) Action Plan on Integrated Hydrologic Systems Research - *Jerry Ayers* (3) Action Plan to Enhance Earth Science Educational Capabilities And Opportunities - *Dave Gosselin* (4) Action Plan to Enhance Research and Service for Soils Data Collection, Interpretation and Use - *Mark Kuzila* (5) Action Plan to Enhance Research on Regional and Global Landscape Characterization - *Jim Merchant* (6) Action Plan on CALMIT's Role in Water Resources Assessment - *Don Rundquist*
4:00 - 5:00 p.m.	Discussion Session VI (Action Plans), CSD Seminar Room.
6:00 p.m.	Dinner with CSD Self-Study Committee and CSD Administrators at hotel.
7:00 p.m.	Review Team discussions at hotel

FRIDAY, SEPTEMBER 8

8:00 - 10:30 a.m.	Discussion with individual CSD staff on sign-up basis, CSD seminar room.
(As needed)	Review Team discussion and report writing (as time permits).
10:45 a.m.	Private consultation with IANR Vice Chancellor, 202 Ag. Hall (if desired).
11:00 - 12:00 noon	Reporting to IANR Vice Chancellor and Administrative Council, Priscilla Grew, Brian Foster and Jim Hendrix, 202 Ag. Hall.
12:30 - 1:30 p.m.	Lunch and reporting to CSD Staff, CSD Seminar Room

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INTRODUCTION

This Self-Study Report for the Conservation and Survey Division (CSD) is a profile of the unit at this point in time. It is presented in three major sections: (1) Background; (2) Current Programs and Achievements; and (3) A Vision of the Future. All sections draw heavily upon documents, staff input, and committee activities going on within the division. The first two sections of the report were prepared by the CSD Self-Study Committee consisting of:

- Marvin Carlson, Professor and Research Geologist (Chair)
- Mark Kuzila, Associate Professor and Soil Scientist
- Darryll Pederson, Professor and Research Hydrogeologist
- Donald Rundquist, Professor and Director of CALMIT
- Karen Stork, Administrative Assistant

The third section of the report was prepared by the CSD Strategic Planning Committee:

- Jerry Ayers, Associate Professor and Research Hydrogeologist
- Francis Belohlavy, Instructor and Soil Scientist
- Robert Diffendal, Professor and Research Geologist
- James Merchant, Associate Professor and GIS Researcher

Programmatic reviews have long been a staple of academic unit administration at the University of Nebraska. The concept was extended to non-academic university units as a means of integrating their performance more closely to the broader goals of the university. More recently, the program review has become less a compilation of accomplishments and more a part of the planning process. One important recommendation contained in the 1994 report of the Institute of Agriculture and Natural Resources (IANR) Program Review Task Force was the following:

> *A future-orientation and tangible outcome-based focus in program review requires a shift in paradigm from emphasizing individual or unit accomplishments to future contributions of the unit as a community of scholars with a common set of values, goals, mission and vision. Change in thinking is also necessary when emphasis shifts from meeting institutional needs to meeting clientele needs.*

These attitudes and attributes have long been a part of the mission of the Conservation and Survey Division.

It is, however, still important to document program accomplishments both as unit achievements and as individual project products to provide the current setting. The ***Background Section*** of this report provides a historical profile of the division and its mission (including appendices for documentation). These records serve to illustrate and define the current program (highlighted in the ***Current Programs Section***), the evolution of the unit mission, and the audience served. This profile can then be assessed against the stated goals and objectives contained in the third section of this report -- ***A Vision of the Future***.

Section I

BACKGROUND

CSD ROLE AND MISSION

The mission of the Conservation and Survey Division (CSD) is derived from state statutes discussed below. Specifically, this includes the following (developed by CSD faculty in 1989):

- To objectively characterize and evaluate Nebraska's natural resources, especially in areas related to geology, hydrology, soil sciences and geography;

- To provide the results of these actions to the public and to governmental and private agencies;

- To maintain a strong capability to conduct research, to provide service, and to educate both public and academic audiences in the following specific areas:

  (1) Quantity and quality of both groundwater and surface water with emphasis on aquifer characterization, aquifer-stream interaction, and water and chemical movement through the vadose and phreatic zones;

  (2) The geologic framework as it relates to water resources, land use, minerals, public safety, economic development and geologic history;

  (3) Soils interpretation with emphasis on their areal occurrence and characteristics;

  (4) Remote sensing and the application of geographic information systems; and

  (5) Development of automated natural resources databases containing the results of the division's survey, characterization and research activities;

- To perform all activities using a multidisciplinary approach involving interaction between division staff members and those of other university units; local, state and federal agencies; and private organizations and individuals.

LEGISLATION

The Conservation and Survey Division was constituted by the State Legislature in 1921 (Section 85-163 of the Nebraska Statutes). The division is unique among state geological surveys in having very specific state statutes related to its mission, which demonstrates the importance the Legislature attached both to defining the organization and designating it as a unit within the university. The division is mentioned in 24 sections of the Revised Statutes of Nebraska. Four of these sections are especially important. Sections 85-163 and 85-165 were passed in 1921, and Section 85-1.104 was passed in 1973.

Section 85-163 pertains to the creation and duties of the Conservation and Survey Division:

> *There is hereby created the Conservation and Survey Division of the University of Nebraska, which shall include the following state surveys: Soil, geological, water and water power, forest, road materials, and industrial. The Conservation and Survey Division shall perform the duties hereinafter defined:*
>
> *(1) Survey and describe the natural resources of the state, including soil, water, water power, potash, forests, road materials, and cement;*
>
> *(2) Study the climate, physical features, geology, and mineral resources of the state;*
>
> *(3) Study and describe the operations, production, and importance of the leading industries of the state;*
>
> *(4) Investigate and report upon conservation problems of the state;*
>
> *(5) Study the water-bearing formations of the state, and assist the citizens in locating water supplies;*
>
> *(6) Secure and preserve the logs of wells drilled in the state, and preserve specimens from each stratum, member, or formation penetrated in said drillings, and inspect such drillings at any time during their progress, and require the person or persons in charge of drilling or prospecting to submit full data in regard to the specimens and logs of the wells;*
>
> *(7) Prepare and show lantern slides or pictures, including motion pictures, of the state's resources, industries, institutions and development, to be used for educational and industrial purposes within the state and for publicity purposes without the state, and secure and distribute other educational films and slides in Nebraska for educational purposes;*
>
> *(8) Compile and record, or publish information with reference to, the state's resources, industries and development, and when called upon to do so by an interested party, investigate and report upon oil, mineral, and gas structures and properties situated outside the state and leases or interests*

therein or thereon being sold or offered for sale in Nebraska. In cases or propositions wherein said investigations show that mineral, oil, or gas properties are misrepresented, or that fraud is practiced in selling same, their officers or agents shall be notified by the Conservation and Survey Division, and if they continue to so operate the same in Nebraska after said notice is given, the division shall report its findings to the Attorney General for action; and

(9) Serve the citizens as an information bureau in regard to the resources, industries and development of Nebraska.

Section 85-164 pertains to the powers, director and expenses of the Conservation and Survey Division:

The Conservation and Survey Division is given police power and authority for the purpose of carrying into effect and performing the duties defined in Section 85-163. The Board of Regents shall appoint a chief or director of the division, who shall direct the work of the division, subject to the approval of the regents. All expenses incurred in carrying out any of the provisions of Sections 85-163 to 85-165 shall be subject to the approval of the regents of the University of Nebraska, and paid out of appropriations made from time to time by the Legislature.

Section 85-165 pertains to Conservation and Survey Division agreements with federal departments:

The Conservation and Survey Division may enter into such agreements with federal departments as may be necessary to carry on cooperative surveys and investigations in the state, the agreements to be subject to the approval of the Board of Regents of the University of Nebraska.

Section 85-1.104 pertains to the establishment of the Institute of Agriculture and Natural Resources, of which the division was made a part:

A University of Nebraska Institute of Agriculture and Natural Resources shall be established at the University of Nebraska-Lincoln, which shall embrace, but not be limited to, the following divisions or administrative units:

(1) College of Agriculture;
(2) Agricultural Experiment Station
(3) Cooperative Extension Service;
(4) Conservation and Survey Division; and
(5) Water Resources Research Institute.

The University of Nebraska Institute of Agriculture and Natural Resources shall be headed by a vice chancellor, and each division or administrative unit shall have a dean, director, or other chief administrative officer.

In the other 20 sections, numerous division functions are specified to include: (1) participation in the Nebraska cooperative soil survey program; (2) membership on the State Water Management Board (no longer in existence); (3) membership on various natural-resource related boards; (4) providing of research information and services to various state agencies and other local governments and agencies; (5) involvement in the certification of well drillers; (6) responsibilities in the management of Nebraska Educational Lands; and (7) cooperation with the Nebraska State Forester. The complete text of the 24 sections from the *Revised Statutes of Nebraska, Reissue of 1988* is included in **Appendix 1** of this report.

HISTORY

Several "geological surveys" were conducted in Nebraska during the late 1800s, usually focusing on a specific area or resource. In 1893, the state legislature established the head professor of geology at the University of Nebraska as the state geologist. Erwin H. Barbour had held this faculty position since 1891 and assumed the duties of both state geologist and director of the State Museum. Dr. Barbour continued these duties into the early 1900s.

Dr. George E. Condra joined the faculty of the university in 1902. In 1913, the legislature legitimized the Conservation and Soil Survey under his direction within the university and defined its work. The 1919 legislature enlarged the duties of the Conservation and Soil Survey to include more geological activities.

Finally, in 1921, legislation was passed which did away with the Conservation and Soil Survey and created a new, broad-based natural resources organization within the university -- the Conservation and Survey Division. Among other things, the law specified that: (1) the division would include a geological survey; (2) the director of the division would be appointed by the regents; (3) expenses incurred in carrying out the act would be subject to the approval of the regents and paid out of appropriations made by the legislature; (4) the division could enter into agreements with federal departments with the approval of the regents; and (5) the 1913 law which provided for the appointment of a state geologist was repealed.

The 1921 act remains the statutory basis for activities of the modern Nebraska Geological Survey. Most changes since 1921 have had to do with administrative procedures within the university.

As director of the new division, Condra was head of the new geological survey and *ex officio* state geologist. He acquired the additional title of dean in 1929, and so served as dean and director of CSD until 1954 when he was succeeded by Eugene C. Reed. Reed received his bachelor's degree from the university in 1923, spent the next eight years as a petroleum geologist in Mexico and Venezuela, then returned to the University of Nebraska where he completed his

graduate studies in 1933. Joining the division that year, he became associate director in 1944. The title of dean was dropped when he succeeded Condra.

A first-hand observer of the debilitating effects of the Great Depression and World War II on state geological surveys, Reed saw that close cooperation with the U.S. Geological Survey (USGS) was critical to achieving success in Nebraska, especially with regard to water resources. After the war and while still associate director, he and Vincent H. Dreeszen devised and supervised a systematic, long-term drilling program in cooperation with the USGS for investigating post-Cretaceous deposits and their important groundwater resources. Reed's experience as a petroleum geologist served the state well because, at an early date, some oil-field technologies were applied to the drilling program. In addition, oil strikes were made in different parts of Nebraska in 1939, 1949 and 1959. With his knowledge, Reed became the focal point for both industry and public interests, the latter entailing oversight of the industry. Through his efforts, a Nebraska Oil and Gas Conservation Commission, which included the state geologist as an *ex officio* member, was established in 1959.

Reed enlarged the geologic staff after becoming director, and during his tenure the Conservation and Survey Division became somewhat more like a geological survey than a broad-based natural resources survey. Subsurface information and techniques were used for applied geology and set the tone of the division.

Dreeszen, named assistant director in 1959, became acting director in 1967 and director in 1969. Also a native Nebraskan, Dreeszen received his bachelor's degree from Peru State Teachers College in 1942, served in the U.S. Navy, then returned to the university after the war and completed his graduate studies in 1949. Joining the division staff that year, he shepherded the drilling program and pursued the study of his principal interest, the Cenozoic rocks of the state and their important water resources.

Dreeszen expanded the scope and scale of the division to more nearly fulfill the provisions of the 1921 act. From 1968 to 1973, this expansion coincided with an increase in the size and complexity of the university structure. In 1968, a tri-fold university system was established with a president over three chancellors. The Conservation and Survey Division became part of the Lincoln campus and reported to the chancellor of that university. In 1973, a reorganization of UNL placed the division in the Institute of Agriculture and Natural Resources, headed by a vice-chancellor. Since that year, the division budget has been included in the institute's budget, instead of being an individually specified request in the total university budget.

The current director of the Conservation and Survey Division is Perry B. Wigley, experienced in basic and applied geology in both the public and private sectors. Wigley received his M.S. and Ph.D. degrees in geology from Virginia Polytechnic Institute. His background includes experience as a professor of geology, assistant director of a geological survey, consultant and exploration manager for an oil company.

ADMINISTRATIVE ALIGNMENT

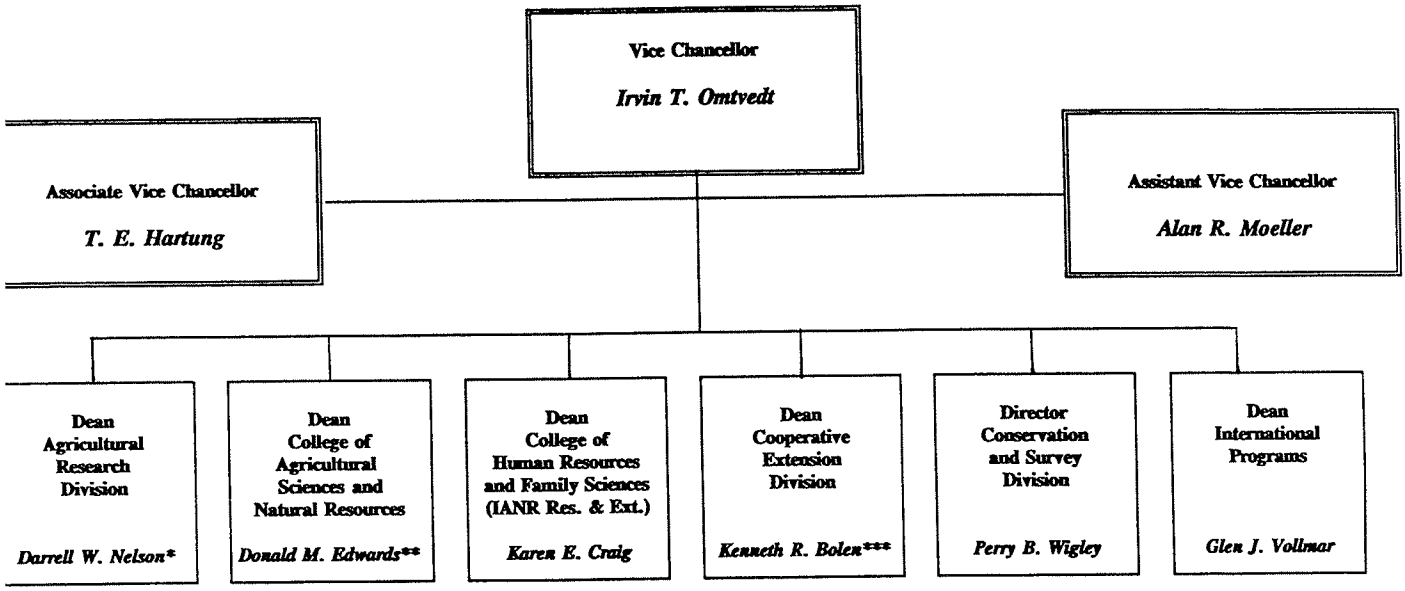
CSD became a part of the newly created Institute of Agriculture and Natural Resources (IANR) in 1973. As such, the division is one of six dean-level administive units reporting to a vice chancellor (see **Figure 1-1**). IANR, in turn, reports to the Chancellor of the University of Nebraska-Lincoln (see **Figure 1-2**). The IANR vice chancellor is also directly responsible to the Board of Regents for matters pertaining to agriculture and natural resources. IANR fulfills the role of the land-grant component of the university to implement focused research, service, teaching, extension and other programs in agriculture (as broadly defined), in natural resources and home economics, as well as target programs that affect Nebraska's communities.

IANR's responsibility as a component of a land-grant institution is to be responsive to the educational needs of the people of Nebraska, the United States, and the international community. The institute's goal is to be the premier provider of educational, research and outreach programs essential for shaping Nebraska's future as a leader in the 21st century in the areas of food, agricultural and agribusiness systems, natural resources and human resources. IANR is dedicated to providing the highest quality programs that are ecologically sound, economically viable, socially responsible and scientifically appropriate. Major activities include seeking new knowledge and disseminating information to students and other clientele. To do so, the institute must be on the cutting edge in its program areas and with the information dissemination process.

In fulfilling its mission as a broad-based earth science unit, CSD, like IANR, has public service, scholarly service, research and teaching functions. Emphasis is presently in the research and scholarly service areas, and teaching is accomplished informally or through joint or courtesy appointments with academic units or on a contract basis. The division is at the forefront of natural-resource-related research and service. The Center for Advanced Land Management Information Technologies (CALMIT), a program area within the division, provides expertise, facilities and equipment for both the analysis and dissemination of natural resources information. The Nebraska Earth Science Education Network (NESEN), an outreach activity of the division, provides a mechanism for improving communication and linkages between K-12 earth-science teachers and resources and professional expertise at the university.

ORGANIZATIONAL CHART
INSTITUTE OF AGRICULTURE AND NATURAL RESOURCES
THE UNIVERSITY OF NEBRASKA - LINCOLN

FIGURE 1-1



Director of Agricultural Experiment Station
* *Dean of Nebraska College of Technical Agriculture*
** *Director of Cooperative Extension*

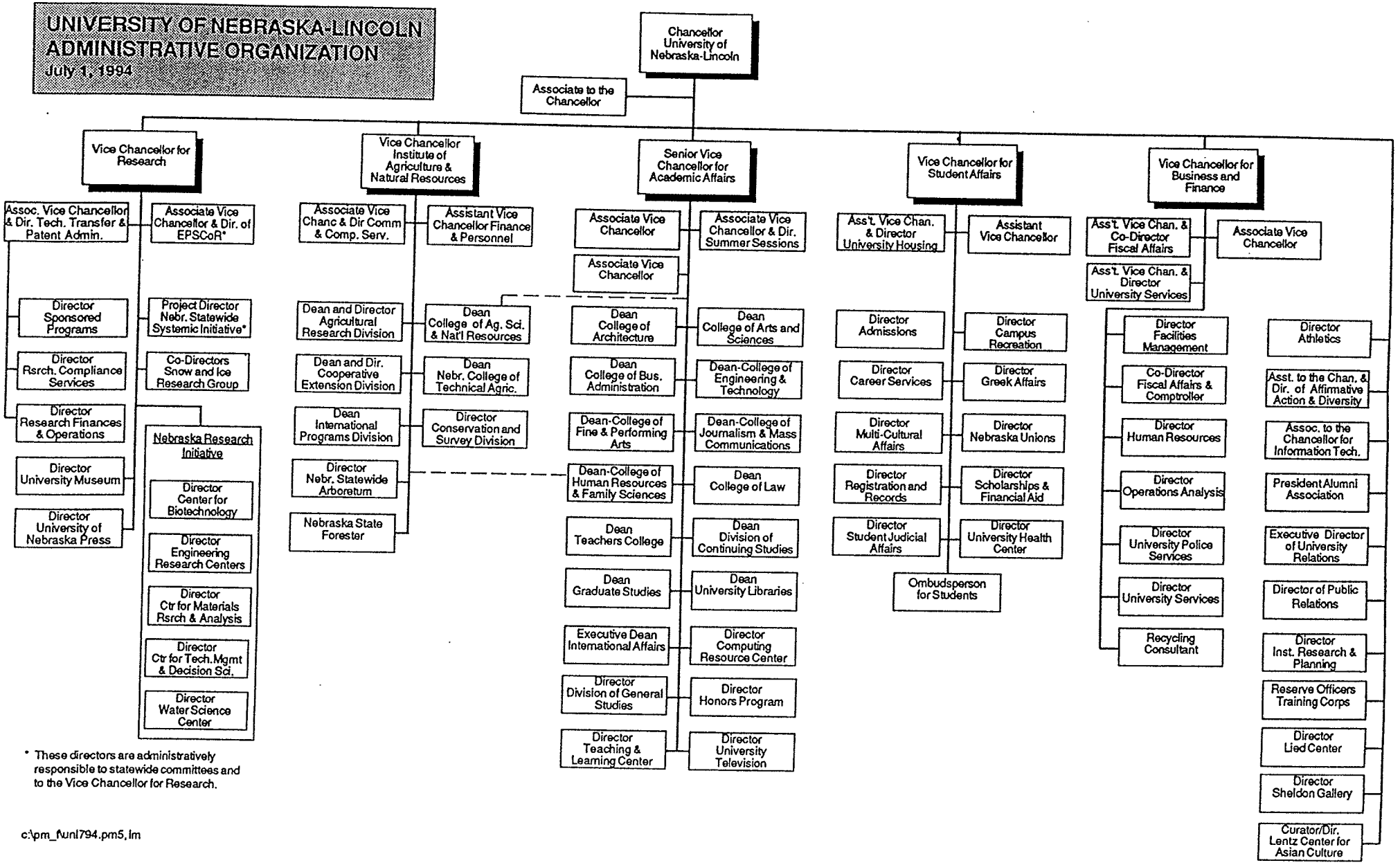
IANR ADMINISTRATIVE UNITS

ACADEMIC DEPARTMENTS	INTERDISCIPLINARY CENTERS AND PROGRAMS	PRIMARY EXTENDED CAMPUS LOCATIONS
AGRICULTURAL ECONOMICS *Gary D. Lynne*	CENTER FOR ADVANCED LAND MANAGEMENT INFORMATION TECHNOLOGIES (CALMIT) *Donald Rundquist*	AGRICULTURAL RESEARCH AND DEVELOPMENT CENTER – Ithaca *Dan Duncan*
AGRICULTURAL LEADERSHIP, EDUCATION & COMMUNICATION *Earl B. Russell*	CENTER FOR BIOLOGICAL CHEMISTRY *Marion H. O'Leary*	NEBRASKA COLLEGE OF TECHNICAL AGRICULTURE – Curtis *Don A. Woodburn*
AGRICULTURAL METEOROLOGY *Blaine L. Blad*	CENTER FOR BIOTECHNOLOGY *Donald P. Weeks*	NORTHEAST RESEARCH AND EXTENSION CENTER – Concord *Robert D. Fritschen*
AGRONOMY *P. Stephen Baenziger (1-1-96, Ken Cassman)*	CENTER FOR GRASSLAND STUDIES *Martin A. Massengale*	PANHANDLE RESEARCH AND EXTENSION CENTER – Scottsbluff *Charles A. Hibberd*
ANIMAL SCIENCE *Elton D. Aberle*	CENTER FOR LEADERSHIP DEVELOPMENT *Allen G. Blezek*	SOUTH CENTRAL RESEARCH AND EXTENSION CENTER – Clay Center *Charles L. Stonecipher*
BIOCHEMISTRY *Marion H. O'Leary*	CENTER FOR RURAL COMMUNITY REVITAILIZATION & DEVELOPMENT *Sam M. Cordes*	SOUTHEAST RESEARCH AND EXTENSION CENTER – Lincoln *Randy Cantrell*
BIOLOGICAL SYSTEMS ENGINEERING *Glenn J. Hoffman*	CENTER FOR SUSTAINABLE AGRICULTURAL SYSTEMS *Charles A. Francis*	WEST CENTRAL RESEARCH AND EXTENSION CENTER – North Platte *Pete Jacoby*
BIOMETRY *David B. Marx*	CENTER FOR WATER AND ENVIRONMENTAL PROGRAMS *Bob G. Volk*	
ENTOMOLOGY *Z B Mayo (9/1/95, Sharron Quisenberry)*	COMMUNICATIONS AND COMPUTING SERVICES *T. E. Hartung*	
FAMILY AND CONSUMER SCIENCES* *Shirley Baugher*	FOOD PROCESSING CENTER *Stephen L. Taylor*	
FOOD SCIENCE & TECHNOLOGY *Stephen L. Taylor*	INDUSTRIAL AGRICULTURAL PRODUCTS CENTER *Milford A. Hanna*	
FORESTRY, FISHERIES & WILDLIFE *Gary L. Hergenrader*	NEBRASKA FOREST SERVICE *Gary L. Hergenrader*	
HORTICULTURE *Paul E. Read*	NEBRASKA STATEWIDE ARBORETUM *James Locklear*	
NUTRITIONAL SCIENCE & DIETETICS* *Marilynn Schnepf*		
PLANT PATHOLOGY *Anne K. Vidaver*		
TEXTILES, CLOTHING & DESIGN* *Rita C. Kean*		
VETERINARY & BIOMEDICAL SCIENCES *John A. Schmitz*		

July 1, 1995

*Includes only extension and research programs in IANR.

UNIVERSITY OF NEBRASKA-LINCOLN
ADMINISTRATIVE ORGANIZATION
July 1, 1994



* These directors are administratively responsible to statewide committees and to the Vice Chancellor for Research.

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FIGURE

PAST REVIEWS

The Conservation and Survey Division has undergone two reviews since it was created in 1921. In 1969 the UNL Vice Chancellor appointed an informal internal committee to "*review the objectives of the Conservation and Survey Division--its present programs, its organization within the University, and its relationships with other units of the University--with the objective of making whatever recommendations the committee deems appropriate to the Chancellor and the Board of Regents.*" This was in response to a proposal to move the division to a state agency.

The committee drafted a proposed statement for the University Board of Regents that was approved by the board in February 1969. Part of that statement read as follows:

> *The Board recommends that the Conservation and Survey Division be maintained as an integral part of the University, as a means of contributing new basic knowledge and teaching in land and water resources....To provide for and to promote an unbiased scientific organization that can relate properly to both short- and long-range needs for education and research in natural resources, the Board of Regents recommends that the services and research of the division be continued as a University responsiblity to the state and that the programs of the division be enhanced in scope and in quality.*

The first comprehensive review of the division conducted by an outside, independent review team occurred in 1989. As part of IANR's comprehensive review process, the purpose of such reviews is to assist in the improvement of research planning, quality, relevance, coordination and program orientation. The review team is to:

(1) assess major strengths and weaknesses of the units being reviewed;

(2) assess the administrative leadership, internal communications, interdisciplinary activities and administrative procedures within the unit;

(3) assess the unit's current research focus and recommend areas for growth or development;

(4) review linkages which exist between campus and off-campus groups and discuss opportunities to enhance these linkages; and

(5) state specific recommendations for improving the unit's effectiveness.

A copy of the 1969 internal review team's report and the 1989 outside review team's report and the division's response are included in **Appendix 2**.

Section II

CURRENT PROGRAMS AND ACHIEVEMENTS

In addition to the mandated activities described in Section I, the division has an improtant role in service, research and teaching activities in the IANR and in numerous academic departments outside the IANR. This section focuses on current programs and achievements in these areas, as well as the administrative structure of the division, including locations and facilities, and a summary of CSD personnel.

ADMINISTRATIVE STRUCTURE

ORGANIZATION OF STAFF

Figure 2-1 depicts the current administrative structure of the Conservation and Survey Division. **Table 2-1** lists the current CSD staff in the programmatic areas, and **Table 2-2** lists CSD staff according to classification, i.e., faculty, managerial/professional and office/service.

All faculty report directly to the CSD director who conducts their annual evaluations. The associate director is responsible for most support staff evaluations. This organization was adopted in 1990 after a faculty committee studied the previous administrative structure and the subject was fully discussed at a faculty retreat in 1989, six months after the previous comprehensive review. The Strategic Planning Committee, established in 1993, acts as a liaison between the director and the faculty and is used by the director as a "sounding board" to get input from the faculty on various proposals and activities.

Faculty meetings are held on the last Tuesday of each month to keep faculty informed about administrative projects and activities (i.e., such as the status of state budgets, strategic planning, etc.) and to discuss other items of interest. Meetings are kept to a reasonable time frame by having all CSD committee chairs send their committee minutes out to faculty over electronic mail, instead of reporting in the faculty meeting (unless there is a special topic that needs discussion and faculty input).

In December each faculty member prepares an Annual Report of Faculty Accomplishments that includes research, scholarly service and teaching activities for the past year. Faculty members then undergo annual reviews with the director who completes an evaluation form that includes ratings in the areas of: program planning, program performance, evaluating and reporting program, relationships and communications, faculty service, and professional improvement. These cumulative annual performance evaluations are important in helping administrators reach promotion, tenure and salary decisions. They also help faculty members gain better insight into both successes and shortcomings in their research and service activities.

FIGURE 2-1

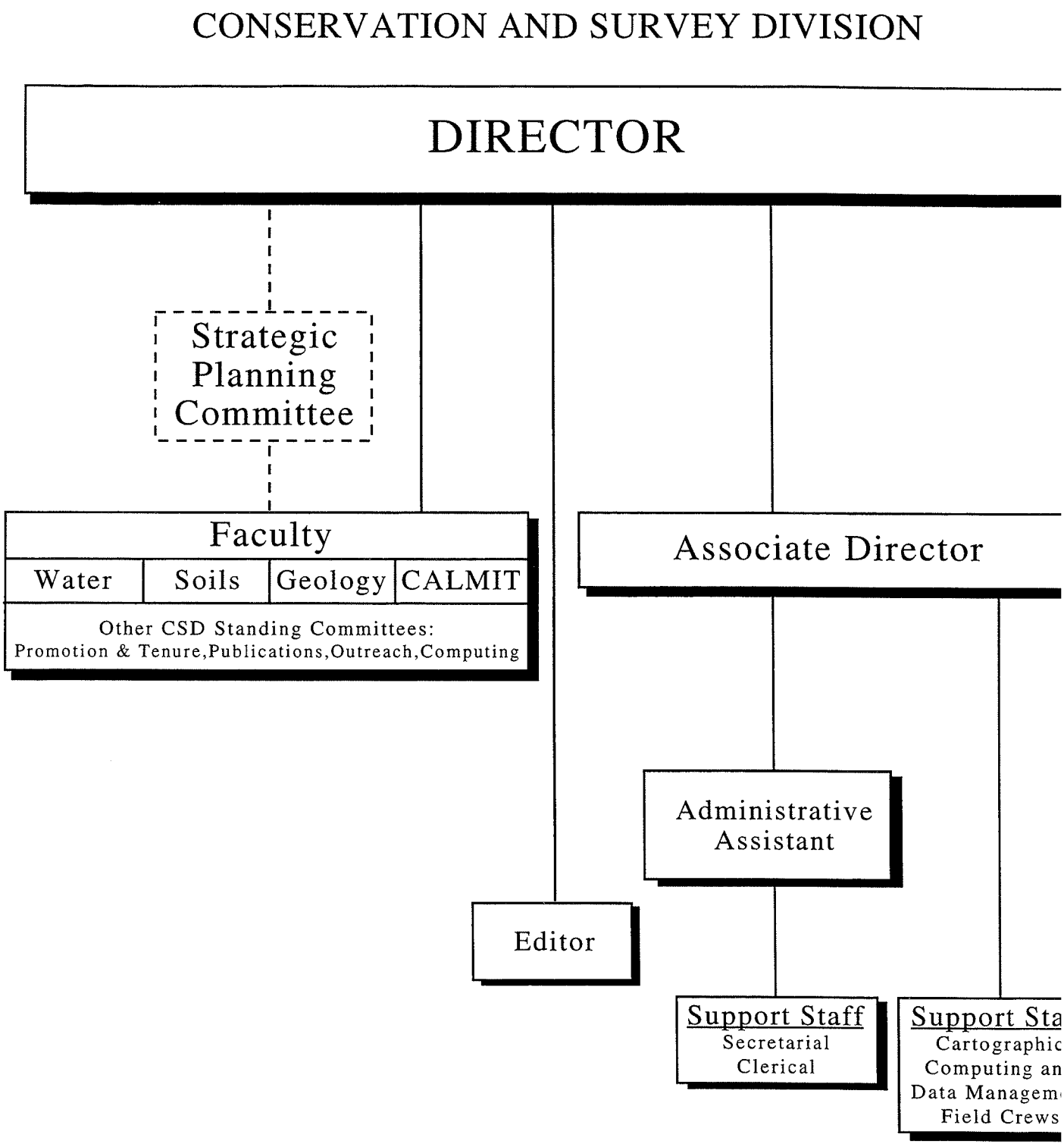

CONSERVATION AND SURVEY DIVISION
DIRECTOR
Strategic Planning Committee
Faculty
Water
Soils
Geology
CALMIT
Other CSD Standing Committees:
Promotion & Tenure,Publications,Outreach,Computing
Associate Director
Administrative Assistant
Editor
Support Staff
Secretarial
Clerical
Support Sta
Cartographic
Computing an
Data Managem
Field Crews

TABLE 2-1

CONSERVATION AND SURVEY DIVISION STAFF CHART

Perry B. Wigley, Director
Duane Eversoll, Associate Director

GEOLOGY PROGRAM

Ray Burchett
Marv Carlson
Hal DeGraw
Bob Diffendal
Duane Eversoll
Ed Harvey
Roger Pabian
Jim Swinehart

WATER PROGRAM

Jerry Ayers (.75 FTE)
Xun-Hong Chen
Jim Goeke (North Platte)
Dave Gosselin
Daryl Heinen (Scottsbluff)
Susan Olafsen Lackey (Norfolk)
Darryll Pederson (.50 FTE)
Steve Sibray (Scottsbluff)
Vern Souders
Mary Spalding
Scott Summerside
TBA - Hydrologist

SOILS PROGRAM

Mark Kuzila, Head
Francis Belohlavy
Steve Hartung
William Markley
Phillip Young
Margaret Warner

CALMIT/GIS PROGRAM

Don Rundquist, Director
Jim Merchant, Associate Director
Jim Lacy
Fiona Renton
Limin Yang (EROS Data Center, Sioux Falls, SD)

SUPPORT STAFF

Administrative Assistant - Karen E. Stork

Secretary/Clerical

Bernice Goemann
Beverly Martin
Judy Otteman
Melba Stemm
Jacki Vogel

Editorial/Cartographic

Charles Flowerday
Deanna Ebbeka
Jerry Leach
Ann Mack

Computing/Databases

James Weir
Les Howard
Duane Mohlman
Bryan Penas

Sample/Field

Gene Debus
Ken Hueske
TBA - Field Support

NESEN Coordinator - Julie Dial

TABLE 2-2

CONSERVATION AND SURVEY DIVISION
Classification and Titles of Staff

FACULTY:	
Ayers, Jerry (.75 FTE)	Hydrogeologist
*Belohlavy, Francis	Soil Scientist
Burchett, Raymond	Geologist
Carlson, Marvin	Geologist
Chen, Xun-Hong	Hydrogeologist
DeGraw, Harold	Geologist
Diffendal, Jr., Robert	Geologist
Eversoll, Duane	Geologist, Assoc. Director
Goeke, James	Hydrogeologist (North Platte)
Gosselin, David	Hydrogeologist/Geochemist
*Hartung, Stephen	Soil Scientist (Wahoo)
Harvey, Edwin	Geologist
Kuzila, Mark	Head Soil Scientist
Lackey, Susan	Geoscientist (Norfolk)
*Markley, William	Soil Scientist (Grand Island)
Merchant, James	Geographer (GIS), Assoc. Director, CALMIT
Pabian, Roger	Geologist/Paleontologist
Pederson, Darryll (.50 FTE)	Hydrogeologist
Rundquist, Donald	Geographer, Director, CALMIT
Sibray, Steve	Geoscientist (Scottsbluff)
Souders, Vern	Hydrogeologist
Spalding, Mary	Hydrochemist
Summerside, Scott	Geoscientist
Swinehart, James	Geologist
*Yang, Limin	Geoscientist (EROS, Sioux Falls SD)
Young, Phillip	Soil Scientist (Valentine)
Wigley, Perry	Geologist, Director
TBA	Hydrologist
MANAGERIAL/PROFESSIONAL	
*Dial, Julie	NESEN Coordinator
Flowerday, Charles	Editor/Publications Officer
Heinen, Daryl	Water Scientist (Scottsbluff)
*Howard, Les	GIS Specialist
Lacy, Jim	CALMIT Facilities Manager
Mohlman, Duane	Data Systems Coordinator
*Renton, Fiona	CALMIT Research Analyst
Stork, Karen	Administrative Assistant
Weir, James	Computing Operations Supervisor

TABLE 2-2 (Continued)

OFFICE/SERVICE:

Debus, Gene	Drill Machine Operator
Ebbeka, Deanna	Cartographer/Graphics Specialist
Goemann, Bernice	GIS Clerical Assistant
Hueske, Ken	Sample Facilities Sup'v.
Leach, Jerry	Cartographer/Graphics Specialist
Mack, Ann	Cartographer/Graphics Specialist
Martin, Beverly	Director's Secretary
Otteman, Judy	Map Sales
*Penas, Bryan	Data Entry Ass't
Stemm, Melba	Clerical Assistant
Jacki Vogel	Receptionist/Account Clerk
*Warner, Margaret	Database Manager, Soils
TBA	Field Technician/Well Reader

* = Funded by Grants

Managerial/professional support staff (also paid monthly) prepare annual reports of activities that are used in their annual evaluation with the director and/or associate director. These evaluations are held each year and follow the same pattern as those for the faculty, except on a slightly different form.

Office/service (hourly) support staff are organized into four areas: secretarial/clerical, cartographic, computing/databases, and sample/field operations. The secretarial/clerical section is supervised and evaluated by the administrative assistant. Most other support staff sections are supervised and evaluated by the associate director. Evaluations for office/service employees are also conducted annually.

Monthly support staff meetings are also held to discuss administrative projects and activities and to give the staff an opportunity to ask questions. Every year support staff are given the opportunity to go on a one-day field trip to visit a CSD research site or interesting geological site in the state. Recent trips have included Ashfall Fossil Beds, Rainbasin region in central Nebraska, and Indian Cave State Park. CSD support staff are a well-respected and integral part of all division projects and activities.

PROJECT ACTIVITY

Most division activity is organized through approved projects. The criteria for establishing a new project is: (1) at least one month of project leader(s) time must be involved and/or the project must have a minimum of $5,000 in external funding; and (2) the project should result in a tangible product (report, map, computer program, etc.). Also, all projects must relate to one of the division's action plans or be a part of the division's core activities, i.e., generally those activities which are performed to fulfill legislated responsibilities.

Proposed projects are submitted to the director and/or associate director on a project description form. These are reviewed and, if approved, given a project number, and returned to the project leader. Projects that require outside funding must be submitted with a copy of the draft proposal prior to any formal submission to the funding agency. Projects that require only CSD support must be submitted before any work is begun or any CSD support is expended on the project. New projects are listed in the monthly CSD staff newsletter, and a complete notebook of project descriptions is kept by the administrative assistant. **Table 2-3** shows a listing of all current CSD approved projects.

COMMITTEES

The division has five permanent standing committees to facilitate and coordinate various activities and a number of *ad hoc* committees which are appointed as issues arise. Current *ad hoc* committees include mapping, drilling/logging, safety, and information. Another important committee, elected by the faculty, is the **Director's Appraisal Discussion Committee** (DADC). This committee, consisting of three tenured faculty members elected for three-year terms, is involved in the director's annual evaluation process. The IANR Vice Chancellor's office provides comments on the director's performance summarized from individual faculty

evaluations. This committee then reviews and discusses these comments, prepares a summarized appraisal of the director's performance, and meets with the director to discuss the summarized appraisal, as well as any specific recommendations based on faculty comments.

The five permanent standing committees are as follows:

Strategic Planning Committee - guides the division's planning activities and is composed of one faculty representative from each of the division's programmatic areas -- geology, water, soils and CALMIT (GIS/remote sensing). Established in 1993 because of IANR's new strategic planning thrust, this committee is responsible for developing and following the progress of CSD action plans as a part of IANR's strategic plan. The committee also acts as a liaison between CSD administration and faculty. When the director needs faculty input on some issue, his request is presented to this committee, and the members, in turn, discuss the issue with the faculty in their programmatic areas and report back to the director.

Computing Committee - has the following charge: (1) to represent the CSD faculty and staff in developing the computing facilities to meet various needs; (2) to analyze the needs for equipment, hardware and software maintenance contracts and operating policies; (3) to develop recommendations to the director based on priorities; and (4) to pursue outside funding for computing equipment.

Outreach Committee - was established in 1990 to help coordinate the division's outreach activities. The committee's charge includes the following: (1) to develop CSD displays for various activities such as Husker Harvest Days and the State Fair; (2) to produce various pamphlets such as the CSD expertise and services directory; (3) to develop slide/tape and/or video presentations about CSD and developing a marketing plan for these; and (4) to identify potential new audiences and develop a plan to reach them.

Promotion and Tenure Committee - Consists of non-administrative tenured CSD faculty with the rank of professor. The committee convenes at least once a year to review activities and credentials of faculty and make recommendations for promotion and tenure. The committee also reviews the progress of specific-term appointment faculty toward tenure and suggests areas for improvement, as well as reviewing the progress of equivalent rank (non-tenured) faculty toward promotion.

Publications Committee - consists of three or four appointed members with the editor and administrative assistant being permanent members of the committee. Charge to the committee is to: (1) review, update and recommend publication policies and procedures to administration; (2) facilitate publication process if problems arise; (3) review effectiveness of CSD publications in meeting objectives; (4) advise the editor; and (5) monitor and advise with respect to inventory and pricing.

TABLE 2-3

LIST OF CSD PROJECTS

WATER PROJECTS

1102	Upper Republican NRD Liaison	Goeke
1103	Platte-Republican Hydrogeology	Goeke
1105	South Central Sandhills Hydrogeology	Goeke
1106	Reservoir Impact on Groundwater Flow	Gosselin, Ayers
1108	Alkali Lakes	Gosselin, Ayers
1109	Geologic/Hydrologic Database for Northeast NE	Lackey
1110	Northern Holt Co., NPS 319 Project	Lackey
1112	1993 Flood Discharges, Raccoon River, IA	Matherne
*1113	Geologic Controls on Permeability, Brule	Sibray
*1114	Geochemistry of U238 in North Platte NRD	Sibray
*1115	Surface Geophysics for Logan East RWS	Lackey
*1116	Characterization & Monitoring in Boyd Co.	Lackey
*1117	Saline Processes, Rock Creek Watershed	Ayers
*1118	Electromagnetic Survey of Oregon Trail	Ayers
*1119	Domestic Well Groundwater Quality	Gosselin, Chen
*1120	Twin Platte NRD Groundwater Quality Study	Gosselin, Goeke
1123	Groundwater Level Observation Program	Wigley
1127	Mid-Nebraska Vadose Zone Sampling Project	Gosselin, Kuzila
1128	Cedar Valley Reclamation District Project	Matherne
1202	Preliminary Aquifer Characterization, MSEA	Spalding
1203	Vadose Zone Agrichemical Leachates	Spalding
1204	Geophysical Logging Test Hole	Ayers
*1205	Wetlands at Kiowa Wildlife Mgmt Area	Matherne
1210	Modeling Transient Hydraulic Behavior in Brule	Sibray
1213	Characterization of Dismal River	Pederson
1215	Groundwater Decline Patterns in NE	Pederson
1216	Groundwater Quality in North Platte NRD	Sibray
1217	Effects of Platte River on Lincoln Wellfield	Pederson
1218	Recharge from Unlined Irrigation Canals	Matherne
1219	Dynamics of Wet Meadows in Sandhills	Gosselin, Matherne
1220	Leukemia Risk from Nitrate-N in Drinking Water	Spalding
1221	Well-head Protection, Lincoln Wellfield	Ayers
1223	Pesticide Management, York GW Recharge Project	Spalding
*1224	Impact of Wetlands on Hydrology, Dismal River	Pederson

* = New Project in 1995

Table 2-3 (continued)

1304	Nebraska's Rivers and Their Valleys	Bentall
1305	Irrigation Well Hydraulics	Ayers, Gosselin
1306	Graphical Analysis of Seismic Refraction	Ayers
1307	Guidelines for Plugging Abandoned Wells	Eversoll
*1308	Monitoring Strategy for GW Protection	Spalding
1309	Analyzing Vadose Zone Air Permeability Data	Chen
*1310	Modeling Organic Contaminants Along Trench	Chen
1311	Trace Metals in Surface and Groundwater	Gosselin
1313	CSD Groundwater Workshops	Ayers, Pederson
1314	Irrigation with VOC-Contaminated Groundwater	Spalding
1315	Impact of Conjunctive Water Use Policy Criteria	Matherne
*1316	High Resolution Seismic Profiling	Ayers
*1317	Azimuthal Geophysical Method/Anisotropy	Ayers
*1318	Generating Synthetic Seismograms by Computer	Ayers
1320	Hydrogeologic Controls on GW Contamination	Pederson
1402	Geobased Data Systems in the Panhandle	
1808	Water Quality Service	
1809	Water Supply Service	
1810	Groundwater Management Assistance	

GIS AND SOILS PROJECTS

2101	Blaine County Soil Survey	Kuzila
2103	Washington County Soil Survey	Kuzila
2105	Cherry County Soil Suvey	Kuzila, Markley
2106	Cheyenne County Soil survey	Kuzila
2108	Garden County Soil Survey	Kuzila
2111	Soil Organic Carbon - MLRA 106	Kuzila
2112	Major Land Resource Area (MLRA) 106 Update	Kuzila
2113	Major Land Resource Area 107 Update	Kuzila
*2114	Deuel County Soil Survey	Kuzila
*2115	Gage County Soil Survey	Kuzila, Belohlavy
2120	Sheridan County Soil Survey	Kuzila, Young
2122	Sioux County Soil Survey	Kuzila
2126	South Central Soils Genesis & Morphology	Kuzila
2132	Revision of Dundy County Soil Survey	Kuzila
2133	Saunders County Soil Survey	Kuzila, Hartung
2137	MLRA-71 Update	Kuzila
2138	Hall County Soil Survey	Kuzila
2204	Spatial Modeling, Conversion of Irrigated Lands	Merchant
2206	Assessment of NPS Pollution on Stream Ecosystems	Merchant
2207	Wetlands to Detect Envionmental Change	Rundquist, Gosselin

Table 2-3 (Continued)

2301	Progressive Soil Survey	Kuzila
2302	Soil Series of Nebraska	Kuzila
*2303	Soil Survey Data to Predict Mobility	Kuzila
*2304	Remote Sensing & GIS Development	Merchant, Howard
2305	Soil Morphology Related to Parent Material Age	Kuzila
*2306	Multimedia Access Prototype AIM Project	Merchant
2307	Loess Characteristics at Naponee	Souders
2308	Prototype GIS for Solid Waste Disposal	Kuzila
2309	Remote Sensing to Monitor Ponds, etc.	Rundquist
2310	Environmental Monitoring with AVHRR Data	Merchant
2313	GIS for the Gudmundsen Sandhills Lab	Merchant
2314	Leadership for GIS Activities in Nebraska	Merchant
2317	Characterizing Wetland Vegetation Canopies	Rundquist
2319	ESIC State Affiliate Administration	
2323	Analysis of Biophysical Parameters with AVHRR	Rundquist
2324	Statewide Databases Using ARC/INFO	Weir
2325	Sensor Technology & GIS for Res. Mgmt (NASA)	Rundquist
2326	Nebraska Land Cover/Land Use Data Base	Merchant

GEOLOGY PROJECTS

3104	Field Geologic Maps of Western Nebraska	Diffendal
3105	Scottsbluff-Cheyenne Quadrangle Mapping	Swinehart
3107	Alliance Quadrangle Mapping	Swinehart
3108	Broken Bow Quadrangle Mapping	Souders
3109	O'Neill Quadrangle Mapping	Diffendal
3110	Valentine Quadrangle Mapping	Swinehart
3111	North-South Tertiary Section, Western Panhandle	Swinehart
3112	Midcontinent Strategic & Critical Minerals	Carlson
3114	Niobrara Stratigraphy of Western Nebraska	DeGraw
3115	"Benton Group" of Nebraska	DeGraw
3116	Dakota Group of Nebraska	DeGraw
3117	Pierre Shale Stratigraphy of Nebraska	DeGraw
3118	Broadwater Stratigraphy	Swinehart, Diffendal
3119	Geologic Map of Morrill County	Swinehart, Diffendal
3122	STATEMAP - Geologic Mapping	Wigley
3124	Chronology and Sedimentology of Sand Hills	Swinehart
*3125	Boyd County Geology & Water Atlas	Lackey
3201	Roadside Geology of Nebraska	Diffendal
3202	Geology of Toadstool Park/Ft. Robinson	Diffendal,Pabian
3205	Geology Along Lincoln's Bike Trails	Pabian
3206	Test Hole Log Book	Burchett

Table 2-3 (continued)

3207	County Geologic Reports	Burchett, Eversoll
3208	Nebraska Geonotes	Burchett
3209	Geology of Pioneers Park Area	Pabian
3210	Minerals & Gemstones of Nebraska	Pabian
*3211	Whitneyan-Arikareean Transition	Swinehart
3302	Pennsylvanian & Permian Stratigraphy	Burchett
3303	Deep Well Stratigraphic Investigations	DeGraw, Burchett
3304	Keith & Garden Counties Alluvial Fills	Diffendal
3305	Plio-Pleistocene Sand & Gravel Bodies	Diffendal
*3306	Dakota Stratigraphy and Tidal Rhythmites	Swinehart
3307	Uranium Resources	
3308	Invertebrate Fossil Handbooks	Pabian
3311	Upper White River-Lower Arikaree Paleovalleys	Diffendal
3312	Crinoids from Lower Stanton Formation	Pabian
3313	Lower Permian Crinoids from Midcontinent	Pabian
3315	Geologic Engineering	Eversoll
3316	Mineral Resources Inventory	Burchett
3317	Low-Level Radioactive Waste Siting	Carlson
3319	Landslides of Nebraska	Eversoll
3321	The Precambrian of Nebraska	Carlson
3322	Stratigraphic Succession in Nebraska (#14A)	Carlson
3323	Western Interior Cretaceous Project (WIK)	DeGraw
3328	Carbonate Rocks in Richardson & Pawnee	Pabian, Diffendal
3329	Late Cretaceous Field Trip	Pabian
3402	Geophysical Investigations	Burchett
3403	Fossil Taxonomy	Pabian
3404	Deep Well Files	Burchett
3801	Mineral Resources Service	
3802	Oil and Gas Resources Service	
3803	Geologic Data Service	
3804	Earthquake Service	

Table 2-3 (continued)

SUPPORT PROJECTS

4307 CSD Internal Newsletter

4318 CSD External Newsletter & Resource Notes

4401 Publication/Map Database
4402 Computerizing Monthly Activity Reports
4403 Maintain CSD Mailing Lists
4404 Automate CSD Sample Database
4405 Automation of Test Holes
4406 Automate Water Well Logs

4801 Media Services
4802 Editorial Services
4803 Nebraska Water Conference Council Service

ACADEMIC SUPPORT PROGRAM

5901 Faculty/Staff Teaching
5902 Faculty/Staff Advising
5903 Nebraska Earth Science Education Network (NESEN) - D. Gosselin, F. Belohlavy, A. Matherne, et al
*5904 Consotrium for the Application of Space Data to Education, D. Rundquist

LOCATIONS AND FACILITIES

The Conservation and Survey Division is located in all or parts of three buildings in Lincoln. It has core storage space near Mead, Nebraska. Field offices are located in Norfolk, North Platte and Scottsbluff. Field soil scientists currently are located in Wahoo, Grand Island, Omaha and Oshkosh. **Figure 2-2** shows the locations of staff and buildings. **Figures 2-3** and **2-4** show the floor plans for CSD offices, laboratories and storage in Nebraska Hall. Division facilities include the following:

The CSD main offices are in Nebraska Hall on the first and second floors and basement (17,400 square feet). The division's storage of samples and cores is located in four locations -- the basement of Nebraska Hall (7,500 square feet), the Georesources Building (1,100 square feet), the Annex on East Campus (4,400 square feet), and at the University's laboratory at Mead (15,000 square feet).

The deep oil and gas well files (room 110) contain various types of records for more than 17,000 such wells drilled in Nebraska.

A geophysical laboratory (room 121) provides a headquarters for capabilities that include seismic refraction, shallow seismic reflection, borehole geophysics (caliper, SP, single-point resistance and natural gamma), and magnetic, electromagnetic, and gravity surveys. Software is available to analyze seismic refraction and reflection studies (both CDP and common-effect methods) and electrical resistivity.

A general laboratory (room 107) includes equipment for basic water chemistry and for preparation, microscopic analyses and storage of sediment samples. Both large and small sieving machines are available, as well as a drying oven, fume hood, a large ultrasonic cleaner, a 6-liter automatic still, and areas for both petrographic and binocular examination of samples.

A rock cutting and rock sample processing laboratory in the Georesources Building is equipped with two diamond saws, two laps, a hood and cabinet storage space. Thin sections and polished sections of sedimentary rocks can be processed that enable researchers to investigate rock fabrics and fossil content. The hood allows researchers to acidify carbonate rocks to study insoluble residues and phosphatic microfossils.

A resources center (library) is located in the basement of Nebraska Hall and includes selected publications from the U.S. Geological Survey, as well as all other state surveys.

The Center for Advanced Land Management Information Technologies (CALMIT) is located on the second floor of Nebraska Hall and occupies approximately 2,000 square feet. CALMIT maintains a broad selection of hardware and software for image processing, geographic information systems, automated cartography, and remote sensing and development.

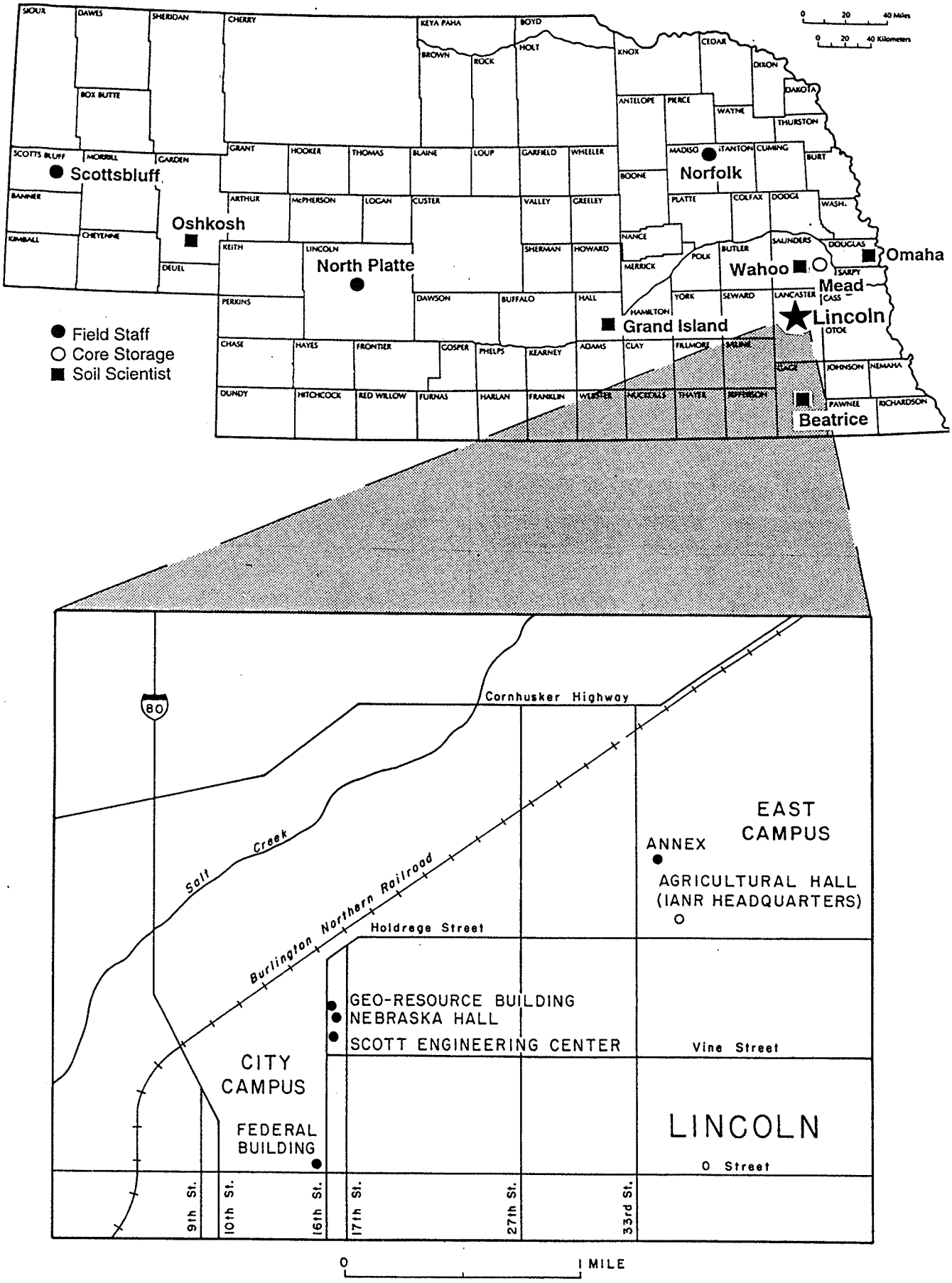


FIGURE 2-2. CSD Locations in Nebraska and Lincoln

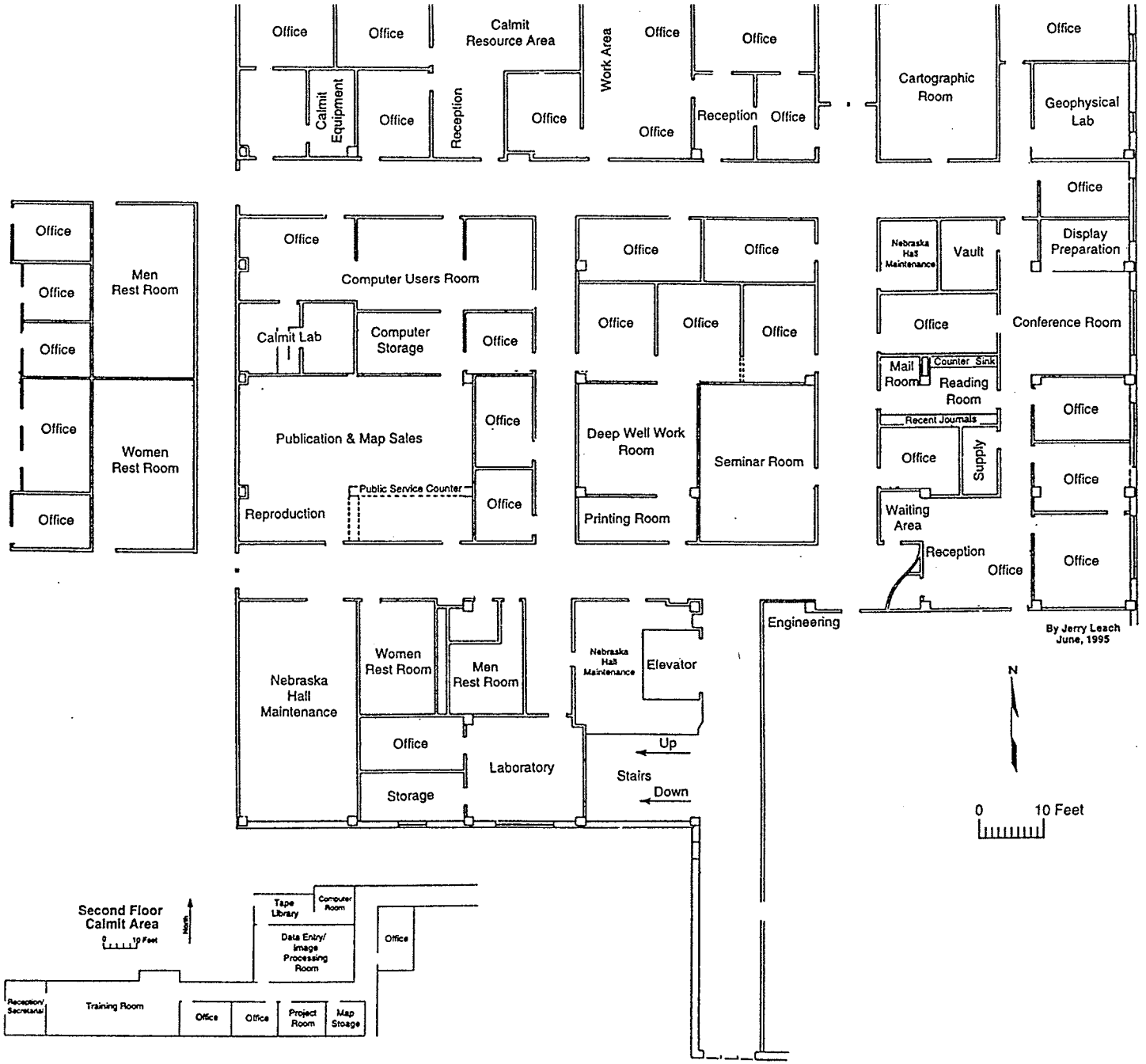
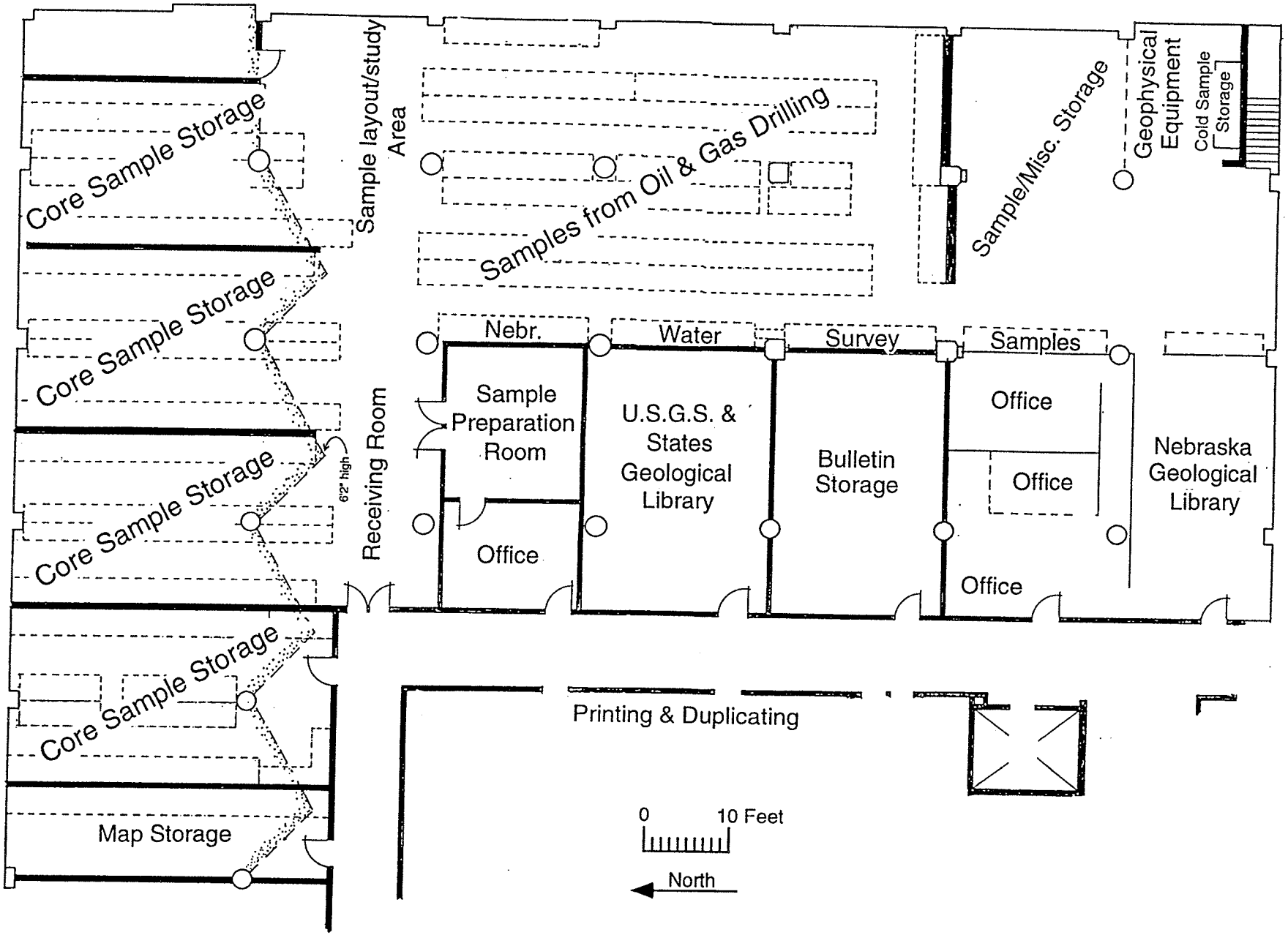


FIGURE 2-3. CSD Floor Plan - Nebraska Hall - East


Core Sample Storage
Core Sample Storage
Core Sample Storage
Core Sample Storage
Core Sample Storage
Map Storage
6'2" high
Receiving Room
Sample layout/study Area
Samples from Oil & Gas Drilling
Sample/Misc. Storage
Geophysical Equipment
Cold Sample Storage
Nebr.
Water
Survey
Samples
Sample Preparation Room
Office
U.S.G.S. & States Geological Library
Bulletin Storage
Office
Office
Office
Nebraska Geological Library
Printing & Duplicating
0
10 Feet
North

CALMIT facilities currently include a network of seven Sun workstations, one DEC 5000 workstation, two Phase X X-terminals, and one Samsung X-terminal. Input devices include an Altek DATATAB 42" x 60" tablet digitizer and Sharp JX610 color flatbed scanner. Output devices include a Tektronix Pxi color plotter, Tektronix Phaser II SDX dye sublimation plotter, a Calcomp 68436 color electrostatic plotter, and numerous black and white laser printers. Approximately 45 gigabytes of disk storage are available, as are several tape storage units (8 millimeter, 9-track, 1-1/4") and CD-ROM drives. Six 486 microcomputers are used for word processing, data analysis and GIS/remote sensing training.

The division has three outstate offices in North Platte, Norfolk and Scottsbluff. The North Platte office (Jim Goeke) is located in the University of Nebraska's West Central Research and Extension Center. The division's Scottsbluff office (Steve Sibray and Daryl Heinen) is located at the University of Nebraska's Panhandle Research and Extension Center. The remaining out-state office is located in Norfolk at the Lower Elkhorn Natural Resources District office (Susan Olafsen Lackey).

BUDGET/FUNDING

Funding for the Conservation and Survey Division is provided as a line item in the budget for the Institute of Agriculture and Natural Resources. These funds are appropriated annually to the university by the state legislature. Most staff and operating expenses are provided by this state funding source. **Figure 2-5** shows CSD funding sources (state and grants) for the past six years. A summary of CSD projects funded by grants and contracts for the past fiscal year (1994-95) is shown in **Table 2-4.**

Besides the state appropriation, research funds are received through the partial return of overhead (indirect cost) dollars from grants generated by CSD faculty. These funds are to be used to enhance research and scholarly activities. The university's overhead return policy was modified in 1992 to return approximately 50 percent of the total funds generated directly to units which generated them. The remaining 50 percent is used to support research related activities. The division director, then, allocates approximately two-thirds of the returned overhead funds directly to the project leaders who generated the grants. The remaining one-third of the returned funds are funds for research administration and overall CSD needs. This policy provides an incentive for researchers to seek outside funding and has helped the division to increase its percentage of extramural funding as shown in Figure 2-5.

Equipment dollars are usually received from the IANR Vice Chancellor's office each year, and in the past have averaged about $25,000 per year. In addition, income is generated from the sale of CSD maps and publications. Most of this income is used to cover publication costs, as well as pay the salary of the map sales assistant. The division occasionally receives income from the sale of its products such as computer-generated maps or the use of its personnel and/or facilities. CALMIT also receives additional income from the sale of products and from various workshops and seminars presented by CALMIT staff.

FIGURE 2-5.
Conservation and Survey Division Funding Sources

	State Funding				
Fiscal Year	Line Item	Equipment	Overhead*	Extramural	Total
1994-95	$2,301,000	$22,800	$64,800	$1,073,703	$3,462,303
1993-94	2,255,000	44,000	55,100	1,306,669	3,660,769
1992-93	2,240,600 (Includes 1% reduction)	23,280	34,900	1,263,464	3,562,244
1991-92	2,165,621 (Includes 2% reduction)	36,400	10,240	862,128	3,074,389
1990-91	2,106,544	22,000	3,865	580,226	2,712,635
1989-90	1,897,082	20,000	3,120	412,932	2,333,154

*Portion of indirect cost (overhead) recoveries from grants and contracts generated by CSD.

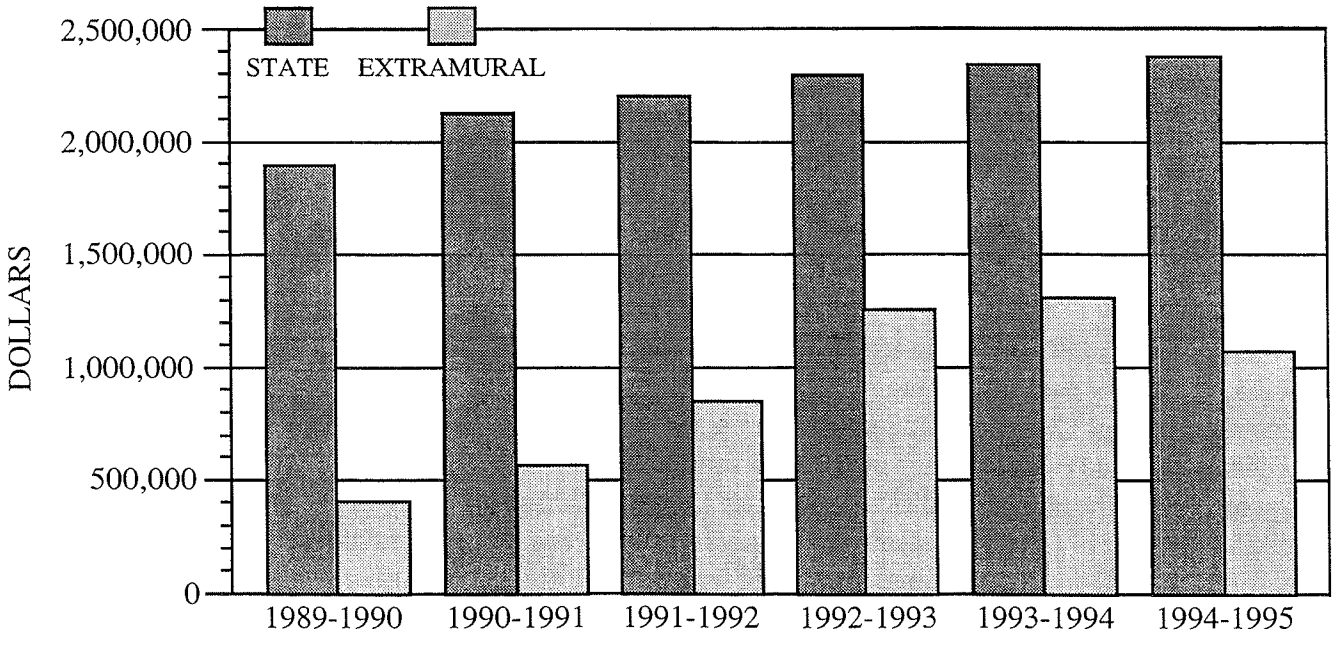


TABLE 2-4

CONSERVATION & SURVEY DIVISION
GRANT ACCOUNTS
FY 1994-95

Account #	Project Leader	Title	Funding Agency	Amount
-04201	Kuzila, M.	State Soil Survey	Nebr. Natural Resources Comm.	$ 155,738
-04601	Sibray, S.	Western Nebraska Hydrogeology	Upper Niobrara-White NRD	10,200
-05201	Kuzila, M.	Cherry Co. Soil Survey	Upper Loup and Middle Niobrara NRDs	16,000
-06501	Kuzila, M.	Saunders Co. Soil Survey	Lower Platte North, Lower Platte South NRDs	- 0 -
-07395	Carlson, M.	LLRW License Review	State Dept. of Environmental Qual.	93,550
-07401	Merchant, J.	Scale-Related Issues in Remote Sensing (Phase 3)	EPA through Univ. of Kansas	- 0 -
-07901	Kuzila, M.	Washington Co. Soil Survey	Papio-Missouri NRD	19,000
-08001	Kuzila, M.	Hall Co. Soil Survey	Central Platte NRD	23,000
-08401	Gosselin, D.	Evaluation of Irrigation Wells as Sampling Mechanisms	USDA/CSRS	- 0 -
-08501	Rundquist D.	Space Grant Consortium	NASA	10,000
-08601	Rundquist, D.	Evaluation of Advanced-Sensor Technology and GIS for Resource Management	NASA	47,712
-08701	Rundquist/ Gosselin	Natural Responses of Shallow Lakes and Wetlands to Detect Climate Change	DOE/NIGEC	75,000

TABLE 2-4 (Continued)

CONSERVATION & SURVEY DIVISION
GRANT ACCOUNTS
FY 1994-95

Account #	Project Leader	Title	Funding Agency	Amount
-08801	Rundquist, D.	Classifying Ag. Land in the North Platte River Valley	State Dept. of Water Resources	$ 104,596
-09001	Gosselin/ Matherne	Dynamics of Sandhills Wet-Lands and Connection with High Plains Aquifer	USEPA	62,952
-09295	Wigley, P.	STATEMAP Geol. Mapping	USGS	40,002
-09501	Kuzila, M.	Deuel County Soil Survey	South Platte NRD	19,300
-09601	Matherne	Kiowa Wildlife Management	Nebr. Game & Parks Commission	- 0 -
-09701	Merchant, J.	Regional and Global Land Characterization via Remote Sensing	NASA	133,000
-09801	Lackey, S.	Independent Characterization & Monitoring in Boyd County	Nebr. Dept. of Environmental Qual.	134,260
-09901	Kuzila, M.	Gage County Soil Survey	Lower Loup and Nemaha NRDs	28,000
-10001	Gosselin, D.	NESEN Activities	NASA	99,920
-10101	Merchant, J.	Conversion & Classification of Remote Sensing & GIS Data for the 1993 Flood Recovery Program	USDA/NRCS	9,995
-10201	Merchant, J.	MAP Project	AIM Institute	34,430
-10301	Gosselin/ Chen	Domestic WellGroundwater Quality in Rural Nebraska	Nebr. Dept. of Health	20,000
			TOTAL	**$1,073,703**

PERSONNEL PROFILES

FACULTY

CSD faculty with the rank of assistant professor or above have either continuous appointments or specific tenure-leading appointments. A total of 13 CSD faculty members have status on the graduate faculty -- 9 as Fellows and 4 as Members. Promotion and tenure guidelines are set by the University of Nebraska Board of Regents and by the IANR. **Table 2-5** (pp. 37-38) presents the CSD criteria for appointment and promotion in rank for both tenured and non-tenured equivalent rank faculty.

In 1994, the division was successful in getting the university to approve and implement an "equivalent rank" system for non-tenured service-oriented faculty positions. In this system, selected scholarly-service-oriented faculty and managerial/professional positions in the division (such as those in field offices and certain positions in Lincoln) were converted to equivalent rank non-tenure track faculty positions. Three managerial/professional positions (Susan Lackey at the Norfolk office, Scott Summerside, a Lincoln water service position, and Limin Yang, a CALMIT research analyst stationed at the EROS Data Center in Sioux Falls, SD) were converted to equivalent rank of Assistant Geoscientist in February 1995. One faculty-service position located in the Scottsbluff office (Steve Sibray) was converted to equivalent rank in March 1995.

All of these scholarly service positions are primarily designed to serve the public. The designation of these positions as equivalent rank will allow the individuals filling these positions to provide scholarly and public service in accord with a defined research role, but without the stringent level of research productivity required for tenure. A specific list of criteria for promotion was developed for the equivalent rank system from assistant geoscientist to associate geoscientist to geoscientist. These criteria parallel those required for promotion from assistant professor to associate professor to professor. The participants in the equivalent rank system will be reviewed annually by the CSD Promotion and Tenure Committee for their progress toward promotion through the system.

A detailed profile for all faculty (except the instructor soil scientists) is included an **Appendix 3.** The division currently has one open faculty (hydrologist) position.

The following soil scientists are supported by grant funds and do not have tenure-leading appointments:

FRANCIS BELOHLAVY	B.S. Agronomy, UNL, 1973 Instructor and Research Soil Scientist
STEPHEN HARTUNG	M.S. Agronomy, UNL, 1983 Instructor and Research Soil Scientist

WILLIAM MARKLEY	B.S. Agronomy, Kansas State Univ., 1979 Instructor and Research Soil Scientist
PHILLIP YOUNG	B.S. Natural Resources, UNL, 1980 Instructor and Soil Scientist

In addition, the following eight university faculty members have courtesy appointments in the Conservation and Survey Division. The purpose of such appointments is to strengthen and encourage interaction between faculty members in different units with similar interests.

MARGARET BOLICK	Curator of Botany and Assoc. Professor of State Museum
FERNANDO ECHAVARRIA	Asst. Professor, Department of Geography
DAVID HARWOOD	Asst. Professor, Department of Geology
ROBERT HUNT, JR.	Assoc. Professor, Department of Geology & State Museum
MERLIN LAWSON	Professor, Department of Geography and Dean of Graduate Studies
DAVID LEWIS	Professor, Department of Agronomy
SUNIL NARUMALANI	Asst. Professor, Department of Geography
MICHAEL VOORHIES	Professor, Department of Geology and State Museum

MANAGERIAL/PROFESSIONAL

The non-faculty CSD staff are divided into two classifications: managerial/professional and office/service. Managerial/professional staff are salaried (exempt) technical and managerial staff who sometimes conduct independent projects. In about 1992, a university classification and pay system was developed for managerial/professional employees consisting of 13 pay grades. The university is still working to implement a promotion system within pay grades for this classification of employees.

The division has nine managerial/professional employees, six on state appropriated funds and three on grant funds (the year in parantheses indicates when they joined the division):

JULIE DIAL	B.S. Geology, S.F. Austin State Univ., 1982 (1994) NESEN Coordiator (grant-funded position)
CHARLES FLOWERDAY	M.A. Education and Theology, Union Theological Seminary, NYC, 1981 (1985) Editor/Publications Officer

DARYL HEINEN	B.S. Hydrogeology, So. Dakota School of Mines, 1993 (1993) Water Scientist (Scottsbluff)
LES HOWARD	M.A., Geography, UNL, 1989 (1989) GIS Specialist (grant-funded position)
JAMES LACY	M.S. Cartography and GIS, Univ. of Wisconsin-Madison, 1994 (1995) GIS Specialist, CALMIT Facilities Manager
DUANE MOHLMAN	M.Ed. Curriculum & Instruction, UNL, 1995 (1986) Data Systems Coordinator
FIONA RENTON	M.S. Geography, Univ. of South Carolina, 1992 (1993) CALMIT Research Analyst (grant-funded position)
KAREN STORK	B.A. English, UNL, 1988 (1985) Administrative Assistant
JAMES WEIR	M.Ed. Education Administration, UNL, 1970 (1985) Computing Operations Supervisor

OFFICE/SERVICE

The office/service classification covers those employees who are paid hourly. These employees are divided into four work areas in the division -- secretarial/clerical, field and sample support, cartographic, and computing. The division currently has 13 office/service positions as follows (the year in parantheses indicates when they joined the division):

GENE DEBUS	Drill Machine Operator (1964)
DEANNA EBBEKA	Cartographer III (1980)
BERNICE GOEMANN	Assoc. Accounting Degree, Southeast (Nebr.) Community College, 1984 (1975) Clerical Assistant III -- CALMIT
KENNETH HUESKE	B.S. Zoology, UNL, 1963 (1987) Sample Facilities Supervisor
JERRY LEACH	Assoc. Degree, Drafting Engineering, Milford (Nebr.) Technical College, 1968 (1968) Chief Cartographer
ANN MACK	Cartographer III (1977)

BEVERLY MARTIN	Secretarial Specialist (1985) Director's Secretary
JUDY OTTEMAN	Staff Secretary III (1985) Head of Map and Publication Sales
BRYAN PENAS	Clerical Assistant II (1993) Data entry (grant-funded position)
MELBA STEMM	Clerical Assistant III (1977) Water service area
JACQUELINE VOGEL	Clerical Assistant III (1994) Accounting and receptionist
MARGARET WARNER	M.S. Textiles, Clothing & Design, UNL, 1984 Computer Software Technician, Soils (1985)
TBA	Field support and well-reading

STUDENTS

While the Conservation and Survey Division is not a degree-granting academic department, students do work for faculty members and provide a valuable contribution on research projects. Some CSD faculty also serve as major professors for students. The division currently employes 21 graduate and undergraduate students, paid mostly on grant accounts, from the following departments: Geology, Geography, Computer Science, IANR Environmental Sciences, Agricultural Meteorology, and Ag. Journalism.

TABLE 2-5

CRITERIA FOR APPOINTMENT AND PROMOTION IN RANK
THE UNIVERSITY OF NEBRASKA
INSTITUTE OF AGRICULTURE AND NATURAL RESOURCES
Revised 9/92

CONSERVATION AND SURVEY DIVISION

I. INSTRUCTOR

A. A master's degree*
B. An interest in natural resources
C. Evidence indicating scientific capability
D. Experience preferable

II. ASSISTANT PROFESSOR

A. All qualifications of lower rank, plus
B. A doctorate degree* preferably with two years' professional skills in natural resources
C. Demonstrated growth in interest and understanding of natural resources

III. ASSOCIATE PROFESSOR

A. A doctorate degree* with minimum five years' professional skills in natural resources (time-in-rank as assistant professor is ordinarily at least 5 years, and typically is 6 years)
B. Demonstrated effectiveness in teaching, research and/or service in natural resources
C. Evidence of professional growth and scientific contributions
D. Membership in graduate faculty preferred
E. Meets position requirements in a highly desirable manner and at a level expected of a well-qualified individual

IV. PROFESSOR

A. A doctorate degree* preferably with ten years' professional skills in natural resources
B. Substantial scientific contributions
C. Sustained record of performance demonstrating competency and effectiveness in teaching, research and/or service in natural resources
D. Meets position requirements in a highly desirable manner and at a level expected of a well-qualified individual (normally 7 years as associate professor)

* Circumstances in rare instances may cause this requirement to be modified.

TABLE 2-5 (Continued)

CRITERIA FOR APPOINTMENT IN RANK
UNIVERSITY OF NEBRASKA
INSTITUTE OF AGRICULTURE AND NATURAL RESOURCES
CONSERVATION AND SURVEY DIVISION

Equivalent Rank (Non-Tenure) System

I. INSTRUCTOR GEOSCIENTIST

A. Master's degree in the geosciences*
B. A record indicating potential for further academic work
C. Recommendations to indicate potential success as a geoscientist

II. ASSISTANT GEOSCIENTIST

A. All qualifications of lower rank
B. At least two years experience in the geosciences
C. Meets position requirements in a highly desirable manner and at a level expected of a well-qualified individual and team player

III. ASSOCIATE GEOSCIENTIST

A. All qualifications of lower rank
B. Normally five or more (typically six) years of experience in the development and execution of geoscience plans of work which demonstrate creativity, credibility, and a high degree of acceptance by the clientele
C. Meets position requirements in a highly desirable manner and at a level expected of a highly qualified individual and team player

IV. GEOSCIENTIST

A. All qualifications of lower rank
B. Recognized by colleagues and clientele for intellectual depth, versatility and effectiveness in geoscience activities, which contribute significantly to programs for the people of the State
C. Meets position requirements in a highly desirable manner and at a level expected in a highly qualified individual and team player (normally at least seven years in the associate rank)

*Circumstances may, in rare instances, cause this requirement to be modified.

PROGRAM HIGHLIGHTS

This section of the report will discuss current division programs and activities, in the areas of research (conducted in the four programmatic areas of geology, water, GIS/remote sensing and soils), scholarly service, teaching and dissemination of information.

RESEARCH

Current division faculty have made significant contributions to research. Investigations undertaken by faculty constitute a good mix of both basic and applied research. Division scientists not only collect basic data on geology, soils water and geography, but also publish on topics dealing with applications of these basic datasets and concepts.

As is the case in many geological surveys nationwide, CSD researchers often summarize results of their work in division publications. The procedure for in-house publications includes technical review by CSD and other scientists, administrative review by the director and an editorial review. Some division faculty have, in recent years, become less inclined to publish research results in CSD documents because they are not regarded as highly as, for example, articles in refereed journals by promotion and tenure reviewers. This may change because the division has now instituted its own peer-reviewed Professional Paper Series.

The criteria for this new series of peer-reviewed publications is: (1) papers should reflect original, high quality scholarship; (2) the research should be related to the CSD role and mission; and (3) the work must not have been published elsewhere. A CSD Editorial Board has been established consisting of three tenured CSD faculty (including one member of the Promotion and Tenure Committee) and at least one outside member either from IANR or another UNL unit. The purpose of this board is to oversee the peer-review process with outside reviewers. To date, one Professional Paper by Roger Pabian was published in 1993. A complete list of CSD publications and those published outside the division by CSD faculty for the past six years is included in **Appendix 4.**

In-house research support for division scientists is impressive in many ways. With regard to field-research support, for example, the division operates and maintains its own drilling rigs, soil-survey vehicles with probes, a field vehicle with telescopic boom for remote sensing, geophysical equipment, well-loggers, seismographs, and more. In addition to having access to university computer facilities, CSD computer support includes centralized services provided through the division's VAX system which runs ARC/INFO for data management, desktop publishing, and various computer capabilities available at CALMIT. Both CSD and CALMIT also have access to the IANR mainframe computer. In addition, all researchers, as well as most staff, have personal computers and Internet access (including electronic mail).

Personnel support for research includes not only clerical but also field/drilling, water-level recording, and shop/maintenance. The division provides a fully equipped and staffed cartographic facility for faculty research projects. CSD scientists also have access to all university library facilities, and an in-house resource center/library is also maintained.

Following is a discussion of current research activities in the four programmatic areas.

Geology. Geologic field mapping is continuing in the north-central parts of Nebraska (O'Neill and Broken Bow 1 x 2 degree quadrangles). Continuing broad-based geologic projects include climatic history as recorded in the Cenozoic deposits, natural hazards research, mineral resources investigations, basic stratigraphy and invertebrate paleontology.

A geology program highlight is the major new thrust of activity in urban geology. A basin-wide effort to gather data on and map the natural resources of the Missouri River basin, particularly as related to earth-science issues, is being mounted by the U.S. Geological Survey and the state geological surveys within the Missouri River Basin. The ten state geological surveys in the project area and the USGS have formed the Missouri River Basin Earth Resources Mapping Group to identify important regional earth-science issues within the basin and to identify methods and establish priorities to address those issues. The first phase of the project will focus on collection and analysis of data. Regional data at scales of 1:500,000 to 1:2,500,000 will be collected for the basin. Where feasible, these data will be entered into a geographic information system. Information will be analyzed by computer and other techniques to provide a regional perspective on earth-science characteristics of the basin.

The second phase is to conduct detailed studies such as the Mid-Missouri Urban/Rural Corridor Study. The state geological surveys of Iowa, Kansas, Missouri and Nebraska, along with the USGS, have already formed a partnership to conduct this detailed study in a corridor along the Missouri River encompassing the cities of Omaha and Lincoln, NE; Council Bluffs, IA; Kansas City, MO, and KS; and Topeka, KS. This corridor is one of the best examples of an area in the United States where expanding urbanization is in conflict with traditional agricultural uses. Geologic information obtained by this study will be essential to understand the carrying capacity of the land, identify potential consequences of land use on the natural systems, and determine methods to reduce or mitigate those conflicts and consequences. Pilot studies are underway in Omaha, NE; Council Bluffs, IA; St. Joseph, MO; and the Missouri trench from Sioux City, IA, to St. Joseph, MO.

Water. The development of an integrated hydrologic systems research program is one of the main goals of the division and is reflected in one of the action plans. Research by many faculty is focusing on the quantitative assessment of the hydrogeologic and geochemical properties of groundwater and surface water systems and their relationships. Chemical characterization of the Western lakes region in the Sandhills has expanded to include integration of remote sensing and hydrogeology with a focus on the Crescent Lake Wildlife Refuge area. Work on the Dismal River is continuing with studies on the contribution of groundwater and wetlands to streamflow through "boiling" sand springs.

Other water-related research efforts include: (1) the study of agricultural nonpoint source pollution in Holt County where monitoring wells have been installed at three Best Management Practices (BMP) sites; (2) a water-sampling regime around high-capacity wells; (3) investigations at a riparian wetland on the North Platte River with both freshwater and alkali components and in paired wet meadows at the Gudmundsen Sandhills Research Lab, examining their general hydrologic dynamics using both physical and chemical techniques; (4) a study in the Panhandle region of the state examining canal and irrigation recharge to groundwater; (5) a study of the saline wetlands located in the Rock Creek Watershed; and (6) a study to clean up contaminated groundwater through irrigation.

CALMIT (GIS/Remote Sensing). An on-going effort in cooperation with the USGS has been land-cover characterization. CALMIT and USGS researchers in 1994 published a unique land-cover database for the contiguous United States. The new database, a prototype for future global land-cover mapping projects, is available on a CD-ROM and can be configured for many purposes. The land-cover map shows 159 "seasonally distinct" land-cover regions in the U.S. CALMIT researchers will work with other IANR faculty to refine this data and develop a current, detailed Nebraska land-cover database. The project received a national award in remote sensing, national recognition from USGS, and was nominated for the international Australia Prize in 1994.

A second major CALMIT research program is aimed at remote sensing and GIS as they relate to water resources. Considerable progress has been made in the area of hyperspectral (more than 100 individual spectral channels) analysis of surface waters and wetland vegetation. One long-term goal is to use hyperspectral remote sensing to quantify the parameters (e.g., turbidity, algal chlorophyll, dissolved organics, etc.) in surface waters that contribute to their optical characteristics. A major effort is underway in the Western lakes region of the Nebraska Sandhills. The work on wetlands is developing unique spectral signatures during the growing season and measuring biomass for individual wetland species. These measurements relate to the production of "greenhouse gases."

Soils. Mapping of the second generation of soil surveys in Nebraska has now been completed, with Cherry County the final county to be done. Second generation soil surveys have now been published for 86 of Nebraska's 93 counties. Seven counties have completed soil surveys awaiting publication. The third generation of soil surveys, based on the update of soils information within Major Land Resource Areas (MLRA), is now underway throughout Nebraska. The division is currently cooperating with the USDA Natural Resources Conservation Service and Agricultural Experiment Stations in Colorado, Iowa, Kansas, Minnesota, Missouri and South Dakota on MLRA soil projects. These projects include updates of older second generation soil surveys in Deuel, Dundy, Gage, Hall, Saunders and Washington counties.

Additional soils research projects include the effect of soil survey updates on soil interpretations, pesticide mobility within terrace soils, and the determination of soil color with a video camera.

SCHOLARLY SERVICE

Service is the foundation upon which the Conservation and Survey Division has been built. "Service" can be defined as a contribution to the welfare of others or a useful labor that transmits data or expertise to secondary users. "Scholarly service," as defined by the University of Nebraska-Lincoln, is the generation, collection, archiving or dissemination of data and information and/or the training of individuals, private groups or governmental agencies either within or outside of UNL which are not considered to be extension or continuing education activities. For example, scholarly service activities include such things as:

- conducting diagnostic tests, interpreting results and providing clientele with the results and recommendations based on those results;
- conducting workshops and training sessions for IANR faculty and staff, Nebraska clientele, national and international agencies and groups;
- consulting and assisting colleagues in the use of computers, statistical procedures and communication techniques;
- assisting in professional development of faculty and staff; and
- providing unbiased information or technical assistance to individuals, private companies or governmental agencies to assist in planning and decision making.

Division public service and scholarly service to the public includes assistance to federal, state and local agencies; private citizens; University of Nebraska departments and extension staff; and professional societies and organizations. **Table 2-6** provides a summary of CSD faculty scholarly service activity for the last four years. These figures are provided from the Monthly Activity Reports which are kept by all CSD staff members. It is important to note the definition of "contact" in understanding these figures. Each time a faculty member provides a service to an individual or a group, it is considered one contact, i.e., speaking to a group of workshop attendees or a classroom full of children is still considered only one contact.

One recent large-scale service activity involving many CSD faculty and staff was preparing for and hosting the 1995 Geological Society of America's North-central and South-central sections in Lincoln. Some 360 abstracts were submitted for the meeting, and over 700 people attended. Faculty assisted as presenters, and support staff worked as registration helpers, field-trip and local drivers, audio-visual aides, sign makers, security and general assistants.

CSD commitment to service pervades the entire organization and includes managerial/ professional and office/service staff as well. Service calls often involve cooperation between programmatic areas. The high esteem in which the division is held throughout Nebraska is largely due to its historic dedication to service and to providing unbiased technical information to anyone who asks.

TABLE 2-6

SUMMARY OF CONSERVATION AND SURVEY DIVISION FACULTY SCHOLARLY SERVICE CONTACTS

	(Jan-June) 1995	1994	1993	(estimated) 1992
AYERS	10	4	1	1
BABCOCK	46	215	44	40
BELOHLAVY	67	393	549	350
BURCHETT	48	102	189	100
CARLSON	56	106	139	130
CHEN	11	2	----	----
DEGRAW	15	37	32	30
DIFFENDAL	284	369	358	350
GOEKE	210	382	340	360
GOSSELIN	75	106	158	150
HARTUNG	11	83	40	40
KUZILA	34	54	64	55
MATHERNE	30	83	55	60
MERCHANT	45	78	92	80
LACKEY	44	87	121	100
PABIAN	115	115	8	75
PEDERSON	215	420	435	350
RUNDQUIST	47	40	23	30
SIBRAY	210	380	532	350
SMITH	----	238	367	370
SOUDERS	12	22	46	40
SPALDING	10	14	23	20
SUMMERSIDE	135	127	----	----
SWINEHART	69	145	112	100
YOUNG	9	66	75	60
ZHANG	----	----	59	50
	1,808	3,668	3,862	3,291

TEACHING

Five of the 20 CSD faculty with academic rank are involved in regularly teaching courses to either undergraduate or graduate students. However, 13 faculty members have appointments to the Graduate faculty. Nine faculty members currently serve on M.S. committees, while six serve on Ph.D. committees.

As an example of the faculty teaching schedules, following are the teaching commitments of CSD faculty in the fall 1994 semester:

Jerry Ayers	Geology 443/843, Exploration Geophysics
Anne Matherne (No longer with CSD)	Geology 498/898, Watershed and Wetland Hydrology
James Merchant	Geography 498/898, Introduction to Geographic Information Systems
Darryll Pederson	Geology 488/888, Groundwater Geology
Donald Rundquist	Geog/Geol/Agron 419/819, Remote Sensing I

Other faculty who teach on an intermittent basis include Roger Pabian, Bob Diffendal, Mark Kuzila and Jim Swinehart.

Division faculty advise both M.S. and Ph.D. candidates. The division has no academic curricula at either the undergraduate or graduate levels; hence, all of the advisees of the CSD graduate faculty are affiliated with other university units. In addition to chairing students' committees for advanced degrees, division faculty may serve as members on committees. University policy requires that when a CSD faculty member chairs a graduate committee, a faculty member from the graduate student's department must be included on that committee. Division graduate faculty have advised students in a wide range of areas, such as: invertebrate paleontology, invertebrate paleoecology, sedimentology, stratigraphy, hydrogeology, environmental geology, soils, remote sensing and geographic information systems, among others.

While the division often supports graduate and undergraduate students through research grants, CSD faculty also provide other forms of non-financial aid such as technical advice and review, and counsel relating to the student's research project. CSD faculty provide expertise not available from other academic departments. Other forms of assistance include the use of drafting room facilities, cartographic expertise, use of computers and digital processing, motor vehicles, and laboratory facilities. Graduate students also have access to basic geologic data that are in the division's care, which include fossil collections, rotary drill and core drill samples, and electric well logs.

Division faculty are also active in the area of non-traditional teaching. They participate in a large number of continuing education activities such as evening classes, off-campus classes, conferences, workshops, seminars and independent study programs in both credit and non-credit programs.

NESEN. Another area where the division has expanded its activity is the area of K-12 education and "teaching the teachers." The Nebraska Earth Science Education Network (NESEN) was conceived by CSD faculty in 1992, in cooperation with other university units, to: (1) promote and enhance K-12 earth-science education; (2) help students become better informed about the complexities of environmental and natural resources problems; and (3) improve the transfer of earth-science information to the K-12 teaching community. Since 1992, a steering committee has been established composed of K-12 teachers and UNL staff from CSD, the departments of Geology and Agronomy, the State Museum and the Teachers College.

During 1994 NESEN membership increased to over 140 Nebraska K-12 teachers. A $200,000 grant was received from NASA to hire a NESEN Coordinator and also to provide computers and Internet hook-ups to seven schools in Nebraska to demonstrate that through adequate educational support staff, high quality materials and a network of dedicated educators, Internet computer connectivity can make a difference in science education. A NESEN newsgroup has been set up on the Internet. Two annual summer workshops are held to assist K-12 teachers in learning more about earth sciences. The 1995 workshops are entitled *"What's in a Rock?"* (Marv Carlson and Dave Gosselin); *"Rural and Urban Applications of Soil Surveys"* (Francis Belohlavy and Mark Kuzila); and *"Understanding the Earth in Four Dimensions"* (Marv Carlson and Dave Gosselin). A 37-page NESEN directory has been produced that includes many sources of earth-science information and educational opportunities, and a quarterly newsletter is provided to members. A video lending library is planned for the fall.

This entire area of earth-science education and outreach has become a major division initiative in the past few years and will continue to grow in the future. The action plan entitled "Enhancing Earth Science Educational Capabilities and Opportunities" will focus on expanding CSD's educational activities.

DISSEMINATION OF INFORMATION

Distribution of information to the public is an important service provided by the division. Part of CSD's mandate is to investigate and record information about the geologically related natural resources of the state. This means the division inventories, analyzes and evaluates the rock and mineral deposits, groundwater supplies and soils of the state. As a result, CSD maintains a huge database, including data on more than 17,000 oil and gas wells and more than 4,700 test holes (drilled for geologic and hydrogeologic research), as well as information on all irrigation and some water wells in the state (more than 100,000 wells).

Using collected data, research results, and the accumulated expertise of the staff, the division fields requests for information and services from citizens, agencies, businesses, cities and towns and other state and local natural-resource organizations. Frequent inquiries involve specific information and assistance on groundwater supplies; environmental matters ranging from the siting of buildings and landfills to groundwater contamination; mineral deposits, including oil and gas; geologic history; identification of rocks and fossils; soils and their uses; and high-altitude perspectives available from remote sensing imagery.

The division distributes information on Nebraska's resources to general and scientific audiences by publishing several series of publications. These include CSD geologic studies, guidebooks, resource reports (examinations of specific resources), water survey publications, soil survey reports, and educational circulars (lay-audience guides to field sites, natural history or hazards, or resource-analysis tools). In addition, atlases, field-guides and division-produced maps and cross sections illustrate various aspects of Nebraska's geology, water, soils or geography. Also available are reprints of articles written by division faculty for scientific journals. A publications catalog listing all material published or reprinted by CSD, as well as the target audiences for each publication series, is available. **Table 2-7** is a summary of the sale of CSD maps and publications for FY 1994-95 (July 1, 1994 through June 30, 1995).

For about 15 years the division has maintained a formal agreement with the USGS designating the division as the Earth-Science Information Center (ESIC) representative for Nebraska. ESIC serves as a clearinghouse for information on maps, remote sensing and digital cartographic data. Free assistance in locating and ordering earth-science information is available upon request. The division's ESIC and map-sales responsibilities include storing and selling all USGS maps for Nebraska, various geologic, soils and wetlands maps, as well as many special-purpose maps, examining, for example, land use, center-pivot irrigation, aquifer characteristics, groundwater pollution, and other aspects of natural resource use.

The ESIC collection of aerial and satellite imagery includes thousands of black-and-white photos, some dating back to the 1930s, for most areas of Nebraska, color-infrared photos dating to the mid-1970s for many counties, and Landsat MSS imagery dating back to 1972. Total coverage of Nebraska with Landsat Thematic Mapper imagery is available for 1986, 1987, 1988 and 1989. In addition, the image collection includes Skylab coverage from the early 1970s, space shuttle radar images of the state, and the results of many special-purpose airborne missions, such as post-tornado photos of Grand Island.

CALMIT houses hundreds of computer-compatible tapes (CCT) acquired by a variety of remote-sensing systems. CALMIT also holds an impressive collection of CCTs containing spatial data. Included in this collection are USGS 1:250,000 quadrangles for all of Nebraska, numerous USGS 1:24,000 quadrangles, all Nebraska National Wetland Inventory data, Digital Line Graphs for the state, digitized soil surveys for 47 counties (2-acre resolution), U.S. Natural Resources Conservation Service STATSGO (state soil survey) and NATSGO (national soil survey) data and numerous others.

TABLE 2-7

CONSERVATION & SURVEY DIVISION
MAP AND PUBLICATION SALES
July 1, 1994 through June 30, 1995

PUBLICATIONS	SALES	NO. SOLD
Conservation Bulletins	$ 83	28
Educational Circulars	5,248	1,170
Field Guides	32	64
General Information Maps & Charts	1,297	260
Geologic Bulletins	90	36
Geological Survey Investigations	96	32
Geological Survey Papers	20	8
Guidebooks	1,694	416
Miscellaneous Publications	38	25
Professional Papers	20	3
Resources Atlases	1,660	120
Resource Reports	780	60
Reprint Series	187	125
Soil Survey Reports	335	96
Test-Hole Reports	344	70
Water Center Reports	40	5
Water Survey Papers	318	90
	$12,282	
MAPS		
Aerial Photos	$ 734	55
Base Maps	151	30
Configuration Maps	44	8
Correlation and Cross Sections	7	2
Deep Well Maps	227	51
Geologic Maps and Charts	263	47
Geologic Resource Maps	24	5
Geophysical Maps	25	5
Land Use Maps	84	33
Metric Maps	1,144	286
Miscellaneous Maps	304	35
Soils Maps	113	38
Topographic Maps	11,946	3,982
Topographic Maps (1 x 2)	312	78
Water Survey Maps	288	115
Wetlands Maps	1,032	344
	$16,698	

Miscellaneous Items (rock boxes, hats, etc.) $ 3,995

TOTAL SALES $32,975

Now that many of the division's databases have been computerized, another information-dissemination technique involves computer-generated maps for specific requests. Again, data automation is one of the division's high priorities, and the final goal is to have a "user friendly" system where a client can sit down at a computer, punch in a few key words and be able to pull up all the information the division has on that topic. A few of the many CSD statewide databases that have been automated and are used to produce computer-generated maps include: oil and gas wells, earthquakes, landslides, land use, lakes, major roads, mineral operations, nitrates in wells, natural resource district boundaries, center-pivot irrigation systems, railroads, registered wells, roads, range and township, sections, streams, soils, test holes, topography, towns, watershed boundaries, water levels, and many more. For producing such maps, the division charges only the cost of computer time and materials.

Examples of requests received by CSD staff for computer-generated maps include the following:

- The city of Gothenburg was preparing a community grant and needed to know how many center-pivot systems were located within a 50-mile radius of the community.

- The Tri-Basin NRD wanted a map of all the registered wells in the NRD, classified by the diameter of the well casing.

- The Nebraska Department of Roads needed the location of all active quarries, pits and mines using latitude-longitude coordinates.

- An engineering consultant needed to know the locations of all registered wells west of the Blue River in Seward County, together with a 1,000-foot exclusion zone around each well. This would indicate the areas where a municipal water well could be drilled.

Section III

A VISION FOR THE FUTURE

This section of the report will examine a vision for the future of the Conservation and Survey Division, including external factors which may affect this vision, as well as CSD's goals and action plans. Also included will be a discussion of future issues or questions which may also affect the role of the division and about which the review team's input is sought.

VISION

The following vision was modified from Director Perry B. Wigley's 1995 program planning and evaluation session with the IANR Vice Chancellor, as well as various other communications.

INTRODUCTION

By the year 2020, the Conservation and Survey Division will be housed in a natural resources facility and will continue to be the focal point for Nebraska-centered earth-science related scholarly service and research. Strong outreach programs will continue for a broad audience ranging from natural resource managers to K-12 teachers and students. The public will have electronic access to all natural resources data collected by the division.

In the short range (3-5 years), changes in emphases in division activity will include more focus on Quaternary geology, continued strong focus on remote sensing/GIS, and strengthening assistance to K-12 education. We will continue our role as the provider of earth science information to the citizens of Nebraska. Another continuing primary area of focus will be the various aspects of water, including conjunctive use, wetlands, and integrated hydrologic systems involving various modelling studies. The Nebraska soil survey will provide increasing expertise in the study and interpretation of Nebraska's soils.

An area of decreased emphasis will most likely involve bedrock geology. As urban geology and other Quaternary programs receive greater attention, bedrock geologic studies, such as those related to petroleum, hardrock mining and traditional bedrock stratigraphy, will most likely have to be de-emphasized.

Cooperation with other agencies in the future will reach beyond the university to include increased cooperation with other states and other federal agencies in studies such as the Urban/ Rural Missouri Basin corridor study with the U.S. Geological Survey. Possible projects might also include the topics of agrogeology (the interface between agriculture and geology) and continued cooperation with the USGS in the study of geologic hazards.

Service will always be one of the most important functions of the Conservation and Survey Division. Without this as a central theme, we are nearly indistinguishable from several

of the academic departments. Research and basic data collection will always be the basic underpinning of our service activities. As noted in the report of the 1989 comprehensive review team, *"the CSD fulfills a valuable niche as an unbiased source of technical information and interpretation to the state of Nebraska."* (P. 12)

Although natural resources issues will undoubtedly change in the future, if the division continues to collect and interpret the basic earth resource data of the state and continues to be seen as an unbiased source of technical information, we will be prepared to address relevant concerns, both now and in the future.

EXTERNAL FACTORS

As natural resources issues arise, two actions commonly take place. First, the issue is defined as a problem to be resolved; and second, an inquiry initiated to determine the historical and environmental context of the problem. All too often, time and funding are focused on the first activity. The second activity can be addressed only if a well-monitored, quality-assured database has been established. Policy makers must recognize that natural resource systems are complex, and they need to distinguish between those complexities that arise from natural processes and those that arise from human-induced stress.

There are many inherent difficulties in planning and developing technically relevent policies to address natural resources issues that are also workable from a legislative (policy) and management (regulation) perspective. Three primary difficulties are: (1) in many cases we do not have sufficient understanding of the natural resource system; (2) even if technical information is available, legislators and technical experts speak distinctly different "languages" which makes it difficult to translate technical information into policy language; and (3) data and information are not easily accessible.

CSD has traditionally provided a technical linkage between the academic expertise of the university and the planning/regulatory agencies at all levels of government. The division will continue to operate within the academic/research/service mission of the university to anticipate and respond to natural resources issues. This will require the continued collection, maintenance and distribution of basic data as well as expertise. The division's role in problem resolution is to evaluate issues in historical, geological and environmental contexts that go beyond immediate problem solving and focus on the issue in the context of a natural resources system. It is within this systemic context that future issues should be defined and anticipated.

Environment and water will continue to be key issues of concern to the people of Nebraska in the next 25 years. However, the state must be prepared to deal with many other crucial issues that either directly or indirectly involve natural resources. Of these, planning and managing land-use will probably be the principal focus. The following issues, all involving natural resources and land use in some way, will be critical to the economic and environmental future of Nebraska, and will have an impact on the future of the Conservation and Survey Division.

Water. Water is Nebraska's most important and abundant natural resource; ultimately, it is part of a natural resource system. Its importance to the state is evident. However, developing effective and equitable policies based on a quantitative understanding of the hydrologic system (especially groundwater and surface water interaction) represents one of the most significant challenges the state will face over the next 25 years.

Some of the future policy issues related to water include: (1) wetlands exploitation, preservation and management; (2) integrated management of ground-water and surface water; (3) managing water resources under the different climatic conditions that may result from global change; (4) waste disposal; and (5) providing an adequate supply of high quality water to rural and urban communities.

The division will make every effort to assure that its research and long-term monitoring and data collection programs continue. It has been these programs that have allowed realistic planning and regulatory activity in the past. Division programs will serve as focal point to place water resources in a context within the total natural resources system.

Energy. In the future, Nebraska will probably continue to be an energy-importing state. Nebraska's agriculture and industry are dependent on energy. Petroleum products have a direct relationship to agriculture as fuel, fertilizers and agricultural chemicals.

CSD will continue its energy resource programs at a reduced level (data collection and applied research programs for oil and gas, geothermal and mineral resources), both to help develop the state's energy resources and to coordinate national programs for additional energy sources in nature or through new technology

Space/Land Resources. This issue has two sides: (1) regional-scale management of large areas such as the environmentally sensitive Nebraska Sand Hills; and (2) land providing an opportunity for development and expansion of industry. Abundant, non-urbanized land is one commodity Nebraska has that other states, especially on the coasts, do not. This land can either be kept open and managed to be enjoyed and preserved/conserved, and or it can be developed for industry and agriculture. Because Nebraska has enough land for both uses, our primary concern should be providing good science, which will help lead to the proper siting of large industrial or agricultural businesses, as well as urban residential development to minimize impacts on the natural systems.

In the future, land-use control will be recognized as the principal management tool to maintain viable natural resources systems and properly manage geological hazardous areas. The academic research of the university must be brought together through the division's resource databases and integrated through information systems to effectively utilize our land resources, whether for public space, maintenance of biological diversity, or new industries. Here CALMIT and other CSD faculty can provide remote sensing and GIS expertise to identify land use.

Agriculture. Agriculture provides the basis for Nebraska's economy and uses and/or impacts much of the state's natural resources. In the next 25 years agriculture will continue to grow as an "industry," and new focused specialties (milkweed, canola, vegetable crops, etc.) will emerge.

More intensive agricultural development in the future will make the division's geology, soil, water and geography programs even more valuable. These programs can provide a comprehensive database of potential economic minerals (limestone, gypsum, etc.) to be used as soil supplements, as well as more specific soil surveys and accurate groundwater data. Farm-level geographic information systems will allow varied agricultural chemical dosages for diverse soil sub-units, and "smart" sprayers will apply herbicides to only those areas where weeds are actually growing, resulting in the use of less fertilizers and pesticides. The division will continue research in this area of GIS; however, farm-level applications are beyond our reach.

Population. In the next 20 years, population will continue to be concentrated in the eastern half of the state, while the entire state will experience an influx of new cultures and nationalities. These new cultures and nationalities bring with them new and different ideas for business, industry and agriculture, and they will develop local and statewide political impact. This infusion of new ideas could greatly benefit the state, but the increased population could tax the natural resources of various areas. Here again, the technical expertise of the division in understanding natural hazards and the potential reaction of natural systems to the stress of utilization and development could be important to policy makers. A focus on urban geology may be of increasing importance since two-thirds of the state's population lives in the two largest cities, Lincoln and Omaha.

GOALS

The mission statement mentioned in Section I of this report highlights the overarching role of the Conservation and Survey Division -- to help create well-informed citizens capable of making sound and rational decisions about natural resource issues. This is accomplished in various ways.

The division provides an integrated program of research, service, education and outreach focused on Nebraska's natural resources. CSD faculty and staff provide critical information and assistance to public agencies, educational institutions, organizations, businesses and citizens working to conserve the state's land, water and vegetation resources. The division collects basic resource data in support of both research and educational programs throughout the university and across the state.

Basic to the division program is research on the state's geologic framework, knowledge of which is necessary to understand the natural resources of Nebraska. Geologic research activities are complemented by strong programs focusing on groundwater, surface water,

wetlands, natural hazards, minerals, oil and gas, land use and land cover (vegetation, wetlands, irrigation) and soils. The CSD Center for Advanced Land Management Information Technologies (CALMIT) provides expertise and statewide leadership in geographic information systems and remote sensing.

The division responds to questions from citizens, agencies, businesses and municipalities for information about Nebraska's natural resources. The division publishes a broad range of reports, articles, maps and atlases, and houses extensive archives of aerial photographs, remote sensing imagery, digital spatial databases, maps and cross-sections showing the variety of Nebraska's natural resources and the influences of human activity.

The following goals, listed with objectives for each, have been developed to assist the division in meeting its mission and role.

GOAL: Provide leadership to establish a stronger focus for natural resources in the university and the state.

- Provide programmatic leadership for natural resources in IANR, including coordinating natural resources research and service and developing a natural resources facility.
- Develop more collaborative relationships to enhance acquisition of natural resources data.
- Increase faculty participation in multidisciplinary natural resources research.
- Increase the division's participation in teaching natural resources courses.

GOAL: Improve service and information dissemination through automation of extensive natural resource databases for the state.

- Provide leadership in establishing a statewide geographic information system (GIS) in cooperation with the Nebraska GIS Steering Committee.
- Design procedures and set priorities for data automation to include assigning longitude/latitude to data.
- Digitize all soils and geologic maps and automate all well data and resource production data. Include support for soil-map digitizing and soil-data automation within soil project agreements.
- Provide leadership to give users "friendly" software to access data.

GOAL: Enhance linkages both within and outside the university and expand outreach activities.

- Increase cooperative projects with state and local agencies, city and county governments, as well as with the departments of Geology; Biological Systems Engineering; Forestry, Fisheries and Wildlife; Agronomy; Geography; Agricultural Meteorology, and others.
- Increase and expand linkages with K-12 educators through the NESEN network.
- Identify and establish projects for additional Educational Circulars and start planning for a regional and/or county atlas series.
- Expand and improve information transfer mechanisms through the Internet, electronic publishing, additional conventional publications, workshops and service.
- Establish additional cooperative agreements with federal agencies to facilitate interagency working relationships.

GOAL: Establish a comprehensive geologic database by 2005.

- Work on cooperative projects with adjacent states and the USGS in the Mid-Missouri Urban/Rural Corridor.
- Provide Quaternary geologic maps and derivative maps for principal urban areas of Nebraska.
- Complete four remaining 1:250,000 scale geologic maps by 2002.
- Establish procedures and documentation for stratigraphic unit compilations and complete the stratigraphic lexicon.

GOAL: Enhance the position of CSD as a center of expertise in integrated hydrologic systems research.

- Quantify groundwater-surface water relationships and the physical characteristics of groundwater flow systems in Nebraska.
- Increase and improve utilization of numerical analysis for understanding subsurface physical and chemical processes, as well as the influences of irrigation wells on groundwater systems.

- Begin investigations in in-situ techniques for measuring aquifer properties and using depositional modeling to predict those properties.

- Strengthen research activities related to wetlands.

- Coordinate with soil scientists on projects related to understanding the relationships between the physical properties of the vadose zone and the distribution of agrichemicals.

GOAL: Enhance the current CSD/CALMIT leadership position in remote sensing and geographic information systems (GIS) within the state, region and nation.

- Expand the use of GIS and remote sensing as routine tools for assessment and management of Nebraska's land and water resources.

- Enhance interaction with other programs in CSD and other units in IANR through cooperative research projects, development of new courses, and cross-listing of courses.

- Enhance methods for improving satellite-based monitoring and analysis of land-surface, environmental and bio-physical conditions at local to global scales of observation.

- Increase field research directed towards collection of basic spectral-reflectance and ancillary data sets, especially as related to aquatic ecosystems.

- Expand existing outreach/workshop program to include additional short courses, visiting scientists and post-doctoral appointments and an international emphasis.

GOAL: Establish the CSD soils program as the primary source of soils expertise and products in Nebraska.

- Increase soils program interaction with other natural resource and environmental programs.

- Develop soil-interpretation products for real estate tax equalization, on-site sewage and solid-waste disposal.

- Provide intermediate automated soils products to clientele, and on completion of soil survey projects, supply clientele with digital (GIS) soils maps and attribute data from CSD and other agencies.

- Enhance information services for landowners and operators.

ACTION PLANS

Since 1989 when IANR instituted its strategic planning activity, a major component of the division's planning process has been the maintenance of on-going action plans. These action plans provide the implementation strategies for addressing division goals. The most recent version of these plans (developed in 1995 for the period 1995-1998) were subjected to an intensive review and priority assessment in a "Visioning Retreat" attended by all CSD faculty and are presented below.

***ACTION PLAN #1:* Accelerate and Expand Acquisition of Natural Resources Data**

ACTION STATEMENT: CSD will expand an accelerated natural resources data acquisition plan to anticipate emerging technical procedures and evolving audience needs including those of the urban areas of Nebraska and the Mid-Missouri Corridor (Kansas City - Omaha area).

BACKGROUND: A primary mission of the Conservation and Survey Division (CSD), as mandated by Nebraska statute and expected by citizens, is the acquisition and preservation of natural resources data. This information serves as the basis for research and decisions both within CSD and across the state. An understanding of the geologic framework of the state is basic to all natural resources programs. If CSD is to continue to anticipate evolving audience concerns and information needs, part of its mapping program must focus on the urban areas of the state which now contain two-thirds of its population.

OBJECTIVES: (1) Complete the geologic mapping for the remaining four of eleven 1:250,000 quadrangles that cover Nebraska. (2) Design geologic mapping to delineate particular areas of stratigraphic, environmental, or resource concern, including those urban areas of the Mid-Missouri Corridor where CSD needs to respond to specific issues and/or audiences. (3) Renew a drilling program to identify stratigraphy, rock properties, hydrogeologic characteristics, mineral resources potential and possible natural hazards. (4) Increase activities in data automation, information dissemination and public and institutional outreach.

ANTICIPATED RESULTS/IMPACTS: The Mid-Missouri Urban/Rural Corridor Study (addressing objective #2) was developed because the area is one of the best examples of a region where expanding urbanization is in conflict with traditional agricultural use. The area contains a number of natural resources necessary to support urban and rural economic and social well-being. Results will have an impact on future land use, including disposal of municipal and industrial wastes and nonpoint pollution. Mapping will improve our ability to find solutions to natural resources problems as needs arise.

ACTION PLAN LEADERSHIP: Faculty working groups will be established to initiate the urban and other mapping and drilling programs. Specific projects will be designed by faculty with emphasis on joint leadership across program areas and with other states.

TIME SCHEDULE: Objective #1 will be achieved within eight years. Other objectives will depending on available funding.

RESOURCES--COMMITTED, REDIRECTED: Faculty resources and core support staff are currently available to achieve objective #1. Some redirection of faculty activity will occur relative to objective #2. Additional technical support staff for field mapping and for site-specific data collection and drilling/logging procedures will be needed. The U.S. Geological Survey is currently mapping Quaternary geology in the Omaha area.

ACTION PLAN #2: Integrated Hydrologic Systems Research

ACTION STATEMENT: The Conservation and Survey Division will continue to elevate the evaluation of water resources from a generally qualitative and descriptive approach to a more quantitative assessment of the geological, hydrologic, and chemical properties of groundwater and surface water systems and their interrelationships.

BACKGROUND: The CSD is responsible for conducting basic and applied research on groundwater and surface water in its natural environment and has completed many projects characterizing the occurrence and distribution of this vital resource. Nebraska is confronted with numerous water-resource related problems including: quality and quantity of groundwater, multiple use of stream flow, effects of climate change on water resources, integrating the use of ground water and surface water supplies, protecting public water supplies, and protecting wetland areas. Dealing with these and other problems requires a quantitative understanding of the physical, chemical and biological interactions that occur as water moves through the various parts of the earth's hydrologic cycle.

OBJECTIVES: (1) Quantify the physical and geochemical relationships between groundwater and surface water in Nebraska. (2) Quantify the movement of water and contaminants through the subsurface by applying and developing analytical procedures. (3) Develop field techniques for the characterization of hydraulic and transport properties in sub-surface materials. (4) Increase activities in data automation, information dissemination and public and institutional outreach. (5) Increase CSD's interaction with governmental agencies to develop appropriate policies for addressing current and future water-resources issues.

ANTICIPATED RESULTS/IMPACTS: Achievement of the first three objectives will provide a credible database for the protection and management of Nebraska's water resources and facilitate a better understanding of the complexities in the hydrologic system. This understanding can be used by other agencies and applied to important regional and national issues.

ACTION PLAN LEADERSHIP: Coordination of research is provided by CSD faculty involved in the study of Nebraska's water resources. Most projects will be designed by individual faculty drawing upon expertise from across the university, including the departments of Geology, Agricultural Meteorology, Agronomy, Biological Systems Engineering, Civil Engineering and Chemistry. CSD will assume a larger role in providing hydrological expertise and guidance to other IANR water-project activities, particularly within the Water Center.

TIME SCHEDULE: Significant progress has been made during the previous action plan period (1992-95). With the continued efforts of CSD faculty, including two new faculty members, additional progress will be made toward achieving the objectives during the next few years.

RESOURCES--COMMITTED, REDIRECTED: Faculty expertise, core support staff and most of the necessary equipment are currently available. Additional field support staff and upgrading of borehole geophysical equipment can be provided by redirected and/or grant funding.

ACTION PLAN #3: Enhance Earth Science Educational Capabilities & Opportunities

ACTION STATEMENT: Expand and redirect the educational activities of the Conservation and Survey Division.

BACKGROUND: Throughout the nation there is an increasing demand for information and data about the environment and natural resources. There is also growing concern about the scientific literacy of the general public, especially in earth sciences. Through its research, scholarly service and outreach activities, one of CSD's primary missions has been to help Nebraskans understand their natural resources. However, to respond to the increasing demand for environ- mental information and the growing concern about earth science literacy, substantial and sustainable changes are required in educational programs and delivery systems. Two primary areas in which changes will be focused are: (1) improving earth science-related materials, programs and delivery systems available to K-12 teachers, and (2) increasing involvement in formal instruction within existing natural resource related courses at UNL.

OBJECTIVES: (1) Enhance in-service training opportunities for K-12 teachers through the Nebraska Earth Science Education Network (NESEN) and CALMIT workshops and at the Nebraska Association of Teachers of Science meeting, including the option of continuing education and/or graduate credits. (2) Formalize linkages and participation in pre-service K-12 science teacher training in Teachers College with possible opportunities for joint appointments. (3) Increase participation in formal instruction within existing UNL courses that focus on natural resources systems--their origin, occurrence, utilization and impacts created by their development. (4) Provide informal CSD educational programs for interested UNL staff and staff of regulatory management agencies on Nebraska's natural resources systems..

ANTICIPATED RESULTS/IMPACTS: The long-term result will be that Nebraska citizens will be better informed so they can make better decisions about the environment. The transfer of information available at UNL to the end-user will be improved. Opportunities are also provided for enhancing linkages with other university units, particularly Teachers College.

ACTION PLAN LEADERSHIP: Will be provided by faculty position with earth-science based expertise, either by redirecting current activity or creating a new equivalent rank position. Formal instruction will be led by faculty with experience and others interested in redirecting their time in this area.

RESOURCES--COMMITTED, REDIRECTED: Specific faculty resources can be made available by redirection of activity (or by a new equivalent rank position upon retirement of current faculty) and by utilizing reimbursements from indirect costs on current faculty projects to provide operating funds.

ACTION PLAN #4: CALMIT's Role in Water-Resources Assessment

ACTION STATEMENT: The Center for Advanced Land Management Information Technologies (CALMIT) is overseeing a focused effort aimed at developing excellence in remote sensing and geographic information systems as they relate to water resources. Such a program will not only enhance the UNL and IANR visibility in water resources, but also will complement the strong program under the aegis of the Conservation and Survey Division.

BACKGROUND: Over the course of the last several years, CALMIT staff have developed considerable experience in applying remote-sensing and GIS technologies to problems relating to water resources. It seems both appropriate and beneficial to "package" and enhance that research experience in conjunction with coordinated IANR/CSD programmatic efforts in water resources.

OBJECTIVES: (1) Develop new approaches in using remote sensing for measuring water quality/quantity in streams, ponds, lakes, and reservoirs. (2) Develop new methods for identifying, measuring, and analyzing emergent wetland vegetation, to include refinement of both canopy architecture and biomass characterizations. (3) Examine new strategies, such as the use of microwave systems, for locating and measuring standing water and wet soils beneath canopies of wetland vegetation. (4) Develop mechanisms to link results of objectives #2 and #3 to the production of greenhouse gases such as methane and carbon dioxide. (5) Integrate remote-sensing and GIS technologies to more fully utilize data derived from groundwater investigations (such as the new project at the Gudmundsen Sandhills Lab where researchers will attempt to link forage production and groundwater levels).

ANTICIPATED RESULTS/IMPACTS: Publications in professional journals, external funding, new opportunities for students, and additional linkages with UNL and IANR units are some of the projected results/impacts.

ACTION PLAN LEADERSHIP: Drs. Donald Rundquist, David Gosselin, James Merchant and Xun-Hong Chen will take leadership roles in this action plan.

TIME SCHEDULE: A significant amount of program development has been completed, but it is estimated that approximately two-three more years will be required to fully develop the research site at Mead. The possibility of establishing a presence at the Gudmundsen Sandhills Lab is being investigated. Some data collection may be done there in 1995.

RESOURCES--COMMITTED, REDIRECTED: CSD resources committed to the activity include equipment purchases, vehicle support, site development (Mead) and student assistance. The highest priority need is for a full-time field technician/field manager.

ACTION PLAN #5: Enhance Research on Regional and Global Landscape Characterization

ACTION STATEMENT: CSD will accelerate and enhance ongoing research efforts directed towards developing methods to map and characterize terrestrial and aquatic landscapes at local to global scales. This program will contribute directly to environmental research programs within UNL and in many state, federal and international agencies.

BACKGROUND: CSD, through the Center for Advanced Land Management Information Technologies (CALMIT), has established a nationally-known research capability focused on developing and evaluating methods for mapping, monitoring and characterizing land and water resources using remote sensing and geographic information systems (GIS). For the past 5 years, CALMIT staff have been engaged in collaborative research with the U.S. Geological Survey's Earth Resource Observations Systems (EROS) Data Center designed to identify methods for large-area land cover characterization.

OBJECTIVES: (1) Expand and focus research efforts on regional and global landscape characterization, and working with USGS/EROS make a major contribution to research that will result in the world's first detailed global land cover assessment. (2) Further establish CSD's standing as a center-of-excellence in regional and global landscape-characterization research. (3) Bring the results of such research to bear upon contemporary issues facing the state and the Great Plains (e.g., nonpoint water pollution and potential impacts of climate change). (4) Increase external funding resulting in additional appointments for students, post-doctoral scientists and support staff. (5) Integrate the research activity outlined above with related UNL and IANR academic and research programs.

ANTICIPATED RESULTS/IMPACTS: Research to date has resulted in development of a digital 1-kilometer resolution land-cover characteristics database for the conterminous U.S. (on CD-ROM), 12 publications and over $750,000 in external funding. In addition, a new graduate seminar called "Land Cover Classification" (GEOG 498/898) has been taught several times. The detailed land-cover database being developed for Nebraska has been identified as one of the five databases most needed by Nebraska agencies affiliated with the Nebraska GIS Steering Committee.

ACTION PLAN LEADERSHIP: Will be provided by Drs. James Merchant, Limin Yang and Don Rundquist of CALMIT with contributions by other CSD,UNL and EROS scientists.

TIME SCHEDULE: The 1-km global land cover database will be completed by 1998. A more detailed (100 meter resolution) land-cover database for Nebraska will be completed in 1997. Ongoing research is anticipated.

RESOURCES--COMMITTED, REDIRECTED: This work is largely grant supported. CSD annually commits approximately .70 faculty FTE (Merchant) and .10 secretarial FTE to this project. In addition, CSD contributes funds to match grant support for travel, computer time, supplies and communication (approximately $12,000 per year, not including indirect costs).

ACTION PLAN #6: **Nebraska Cooperative Soil Survey**

ACTION STATEMENT: CSD will strengthen the cooperative soil survey by employing state-of-the-art technologies in the acquisition, analysis and distribution of soils spatial and attribute data.

BACKGROUND: CSD soil scientists collect, interpret, document and maintain extensive data on Nebraska's soils. This data includes maps, reports, computer databases, site-specific soil investigations, and interpretive summaries that serve as the framework for sound and informed decisions concerning Nebraska's land resources. Soils play a key environmental role with respect to water quality, wetlands, agricultural production, urban utilization and other non-agricultural uses. The soils program must keep abreast of emerging technologies and evolving clientele concerns and make the best use of current technology to provide the information necessary for the stewardship of Nebraska's natural resources.

OBJECTIVES: (1) Implement a systematic approach in gathering, analyzing, interpreting and distributing soils data through the integrated use of digitization, GIS, GPS and remote sensing. (2) Expand the role of soil scientists in providing technical assistance through the proper interpretation of soil survey data. (3) Increase the number of soil scientist positions in order to meet objectives #1 and #2.

ANTICIPATED RESULTS/IMPACTS: Anticipated results include: (1) developing new and improved analytical techniques using state-of-the-art technologies; (2) developing new and improved interdisciplinary research and service projects to provide a holistic concept of natural resources stewardship within Nebraska's economic, social and political setting; and (3) establishing pedologist positions at regional research centers to increase linkages, perform soils research and provide soil interpretations for clientele.

ACTION PLAN LEADERSHIP: Overall leadership will be provided by Mark Kuzila. Project leadership will be provided by Francis Belohlavy, Steve Hartung, Chuck Markley, Margaret Warner and Phil Young.

TIME SCHEDULE: The basic framework is in place. Development of objectives #1 and #2 will begin immediately and continue to evolve throughout the action plan period. The attainment of objective #3 depends on the acquisition of resources.

RESOURCES--COMMITTED, REDIRECTED: The soils program operates on approximately 80 percent grant funds. Some current funding will be redirected from field activities to data interpretation, digitizing and distribution. Additional funding will be needed to meet objective #3. Additional operating costs include: (1) computer upgrade ($20,000); (2) replacement of two field vehicles ($60,000); and (3) Geographic Positioning System (GPS) for each soil scientist ($10,000 -- computer upgrade mentioned above includes laptops for use with GPS).

FUTURE ISSUES

Many issues could affect this future vision of the Conservation and Survey Division. Some issues are internal and under our control; others are outside the division and involve decisions made by others. These issues include: (1) staff retirements in the next 5-10 years; (2) funding for future needs such as data automation and technical support positions; (3) the administrative placement of the division in the university structure; and (4) the physical location of the division, perhaps in a new natural resources facility.

Information on these issues is presented below in the hope that the review team can provide input on possible opportunities to address these issues.

Staff Retirements

Currently the division has six senior faculty members (all geologists) who will reach age 65 by the year 2001. In addition, two support staff persons (one clerical and one field position) are currently over the age of 65. So the possibility exists that in the next five to six years the division could lose up to eight staff.

This provides the division with a potential problem in loss of expertise; however, this situation also provides an opportunity to change the focus of division programs and staff into emerging areas of interest. It may also be possible to increase the number of support staff along with faculty, as occurred after a previous retirement. The high salaries of these senior faculty may enable the division to hire a new faculty person at a much lower salary, along with a support staff position to either assist that faculty or fill an overall need, such as technical field support.

In order to be prepared for this future scenario, a staffing plan must be developed and priorities established regarding any vacancies.

Funding for Data Automation and Other Needs

Finding dollars for "unglamorous" tasks such as data automation and technical field support is always difficult. In the short run, salary savings and some grant monies have been used to hire students to assist in data entry. However, over the long run, the goal is to develop a "user friendly" computer system where the client can use a computer to find any information the division has (publication, maps, aerial photos, etc.) on a particular area. To accomplish this goal will require a new faculty position to lead the division's data automation activities.

The obvious way to get this new position is to redirect a faculty position into this area when someone retires. However, that could be five or more years away. What possibilities exist in the interim to obtain such a position when state funding for new programs is not realistic? One possibility is to identify a benefactor or user-audience to fund a temporary position to enhance the data-automation program.

Future Administrative Placement and New Facility

These two issues are closely related and should be discussed together. The proposal for a new natural resources facility has been around for many years. In 1991-92, the CSD director chaired a committee to develop a proposal for such a building. This proposal was unsuccessful and did not make it on the university's capital construction list, but it was on the university's 1994-95 list for planning dollars.

Then in late 1993, another committee (The Natural Resources/Environmental Sciences Planning Committee) was formed to develop a programmatic emphasis before discussing the possibility of a new natural resources facility. The CSD director was a member of this committee which developed a concept paper on *"Environmental Sciences/ Natural Resources Programs for the 21st Century at UNL."* The discussion had now grown to include environmental sciences and natural resources and now involved a program AND facility planning effort.

Meanwhile another committee had been established -- The Natural Resources Strategic Planning Committee, with the CSD associate director as a member. The purpose of this committee, appointed by the IANR Vice Chancellor, was to develop a strategic plan for natural resources. Programmatic needs were to be identified more broadly than at the unit level.

The final concept paper from the Natural Resources/Environmental Sciences Planning Committee noted that faculty from a number of related natural resources units at UNL should be brought together *"to develop meaningful, effective programs to deal with environmental/natural resource problems with the ultimate goal of maintaining current human quality of life on a sustainable basis."* To accomplish this goal, the paper noted that *"a new entity (should) be created at UNL where all existing programs in natural resources/environmental sciences can be brought together into an integrated, cooperative, focused effort having a common mission....One model could be the creation of a School of Natural Resources and Environment co-joined with a Center for Ecosystems Studies, or some similar name (Federal). This arrangement would facilitate disciplinary interaction and synergy in dealing with the challenge of holistic resource management for the 21st century."* The paper goes on to say that *"the successful implementation of this plan will require the development of an environmental sciences/natural resources complex to meet program objectives."*

A *"Proposal for a School of Natural Resources and Environmental Sciences"*, incorporating the work of both committees, has now been developed by Dr. Steve Waller. The next step is to appoint a faculty committee from interested units to evaluate the development of a School of Natural Resources/Environmental Sciences and to discuss the appropriate administrative structure.

The Conservation and Survey Division has always been seen as a major part of this concept of a new facility and program bringing together natural resources units in UNL. The division director and many of its faculty maintain that a natural resources unit **already** exists at UNL -- the Conservation and Survey Division. If an integrated program bringing together

units having natural resources interests is desired, these units could join the division. In that scenario, the CSD director would become the head of the School of Natural Resources, and this unit would remain as a division of IANR. However, one of the ideas currently proposed for the administrative placement of this School of Natural Resources would have it located one step lower in the IANR administrative structure.

One of the important issues for the future of the division, then, is the question of whether or not the School of Natural Resources/Environmental Sciences becomes a reality, whether the division becomes a part of this school, and the administrative placement of this school in IANR.

These, and many other emerging issues, will affect the future vision for the Conservation and Survey Division. Some issues will be within our power to influence; others will not. The one constant that will remain is change -- change in issues, change in audience and change in priorities. But one thing will not change: The Conservation and Survey Division, as a unique unit within the university and the state, will continue to respond to the research, service and educational needs of Nebraska's citizens related to all aspects of our natural resources.

APPENDICES

APPENDIX 1

NEBRASKA STATUTES RELATING TO

CONSERVATION & SURVEY DIVISION

2-1504.02. Commission; advisory committee; membership; purpose. The Nebraska Natural Resources Commission shall establish a technical advisory committee to assist it in the performance of its duties. The committee shall consist of the dean or director of the Conservation and Survey Division of the University of Nebraska, the director of the Water Resources Research Institute of the University of Nebraska, the director of the state agricultural extension service, the Director of Water Resources, a representative of the office of the Governor, a representative of the Department of Health, a representative of the Department of Environmental Control, a representative of the Department of Economic Development, a representative of the Department of Roads, a representative of the Game and Parks Commission, one representative each from the United States Army Corps of Engineers, Department of Agriculture, and Department of the Interior if named to so serve by their respective secretaries.

Source: Laws 1972, LB 542, § 4; Laws 1977, LB 510, § 3.

(d) NEBRASKA SOIL SURVEY FUND

2-1596. Soil survey programs; legislative intent. The Legislature finds that an accelerated completion of modern soil surveys will be an asset to the State of Nebraska and good for the general welfare of the citizens of the state. The Legislature further finds that the completion of modern soil surveys can be most appropriately accomplished by accelerating, in a manner deemed appropriate by the Nebraska Natural Resources Commission, state financial input into the combined state and federal effort currently being conducted cooperatively by the United States Department of Agriculture, Soil Conservation Service and the Conservation and Survey Division, University of Nebraska. It is therefore the intent of this Legislature to embark upon an accelerated program for the completion of Nebraska's modern soil surveys and to recommend that the State of Nebraska and the Legislature appropriate the funds necessary to carry out this accelerated program during the years required for its completion.

Source: Laws 1976, LB 180, § 1; R.S.1943, (1977), § 2-3273.

2-1598. Nebraska Soil Survey Fund; how expended. The Nebraska Soil Survey Fund shall be expended by contractual agreement with the Conservation and Survey Division, University of Nebraska, for the purposes of accelerating the program of modern soil survey throughout the state in such manner as the Nebraska Natural Resources Commission shall deem proper and necessary.

Source: Laws 1976, LB 180, § 3; R.S.1943, (1977), § 2-3275.

2-15,100. Water planning and review; how conducted; reports; assistance. The state water planning and review process shall be conducted under the guidance and general supervision of the Director of Natural Resources. The Nebraska Natural Resources Commission shall approve the form and content of all reports produced through the planning process. The director shall be assisted in the state water planning and review process by the Department of Water Resources, the Game and Parks Commission, the Department of Agriculture, the Policy Research Office, the Department of Health, the Department of Environmental Control, and the University of Nebraska-Lincoln Water Resources Center and Conservation and Survey Division. In addition, the director may obtain assistance from any private individual, organization, political subdivision, or agency of the state or federal government.

Source: Laws 1981, LB 326, § 2; R.S.Supp.,1982, § 2-3283; Laws 1984, LB 1106, § 38.

2-15,108. Water Management Board; created; members; qualifications; office space and staff support; quorum. There is hereby created the Water Management Board. The board shall consist of five members including the Director of the Conservation and Survey Division of the University of Nebraska, the Director of the Game and Parks Commission, the Director of Natural Resources, and two members who shall have demonstrated experience in the field of natural resources and who shall be appointed by the Governor. One of the two appointed members shall have expertise in the field of water project development and management. The Director of Natural Resources shall serve as chairperson of the board.

The Water Management Board shall be located within the Nebraska Natural Resources Commission which shall provide office space and staff support for the board. A majority of the members of the board shall constitute a quorum for the purpose of transacting business and every act of a majority of the members shall be deemed an act of the board.

Source: Laws 1984, LB 1106, § 2.

2-15,115. Agencies or political subdivisions; provide information; when. The Conservation and Survey Division of the University of Nebraska, the Department of Agriculture, the Department of Economic Development, the Department of Environmental Control, and other state agencies and natural resources districts and other political subdivisions shall furnish opinions, studies, data, research, or other information which has been compiled by or is in the possession of such agencies or political subdivisions when requested to do so by the Water Management Board.

Source: Laws 1984, LB 1106, § 9.

2-15,120. Board; request for assistance; authorized. The Water Management Board may request assistance from the Department of Economic Development, the Department of Environmental Control, the Department of Water Resources, the University of Nebraska Institute of Agriculture and Natural Resources, the Conservation and Survey Division of the University of Nebraska, or any other state agency if necessary to carry out its duties pursuant to section 2-15,119.

Source: Laws 1987, LB 146, § 3.

46-2,109. Streams with need for instream flows; identification; study. Each natural resources district and the Game and Parks Commission shall conduct studies to identify specific stream segments which the district or commission considers to have a critical need for instream flows. Such studies shall quantify the instream flow needs in the identified stream segments. Any district or the Game and Parks Commission may request the assistance of the Conservation and Survey Division of the University of Nebraska, the Nebraska Natural Resources Commission, the Game and Parks Commission, the Department of Environmental Control, the Department of Water Resources, or any other state agency in order to comply with this section.

Source: Laws 1984, LB 1106, § 25; Laws 1985, LB 102, § 14.

46-604. Certificate of well driller; copies; disposition. The Director of Water Resources shall retain the certificate of well driller and the registration form and shall provide one copy of each to the natural resources district within whose boundaries the well is located and one copy of each to the Conservation and Survey Division of the University of Nebraska.

Source: Laws 1957, c. 200, § 4, p. 703; Laws 1961, c. 227, § 4, p. 673; Laws 1961, c. 230, § 3, p. 685; Laws 1986, LB 886, § 3.

The Division is also mentioned in Section 46-615; however, its function related to this statute was not required after June 30, 1972.

46-658. Control area; how determined; considerations; hearing; initiated by district; when held; notice; published; determination by director; order designating control area; modification of control area boundaries; procedure. (1) An area may be designated a control area by the director following a hearing initiated in accordance with subsection (3) of this section if it shall be determined, following evaluation of relevant hydrologic and water quality data, history of developments, and projection of effects of current and new development, that development and utilization of the ground water supply has caused or is likely to cause within the reasonably foreseeable future the existence of either of the following conditions:

(a) An inadequate ground water supply to meet present or reasonably foreseeable needs for beneficial use of such water supply; or

(b) Dewatering of an aquifer, resulting in a deterioration of the quality of such ground water sufficient to make such ground water unsuitable for the present purposes for which it is being utilized.

(2) When determining whether to designate a control area because of the existence of any of the conditions listed in subsection (1) of this section, the director's considerations shall include, but not be limited to, whether conflicts between ground water users are occurring or may be reasonably anticipated or whether ground water users are experiencing or will experience within the foreseeable future substantial economic hardships as a direct result of current or anticipated ground water development or utilization.

(3) A hearing to designate a control area may be initiated by a district whenever it has information, sufficient in the opinion of the board of directors, to require that any portion of such district should be designated as a control area. The board of directors shall report such information to the director with a request that a hearing be held to determine if a control area should be established. The request shall be accompanied by a general description of the area proposed for inclusion in such control area.

(4)(a) Within thirty days after a hearing has been initiated pursuant to subsection (3) of this section, the director shall consult with the district and fix a time and place for a public hearing to consider the information supplied and to hear any other evidence. The hearing shall be held within one hundred twenty days after it has been initiated, shall be open to the public, and shall be located within or in reasonable proximity to the area proposed for designation as a control area. If, from information submitted by the district or otherwise available to the director, the director has reason to believe that area other than that identified by the district should be considered for inclusion in any control area which would be established as a result of such request, he or she shall so notify the district or districts whose boundaries encompass such additional area. Notice of the hearing shall be published in such newspapers as are necessary to provide for gen-

eral circulation within the geographic area at least once each week for three consecutive weeks, the last publication to be not less than seven days prior to the hearing. The notice shall provide a general description of all area which will be considered by the director for inclusion in the control area.

(b) At the hearing, all interested persons shall be allowed to appear and present testimony. The Conservation and Survey Division of the University of Nebraska, the Nebraska Natural Resources Commission, and the Department of Environmental Control shall offer as evidence any information in their possession which they deem relevant to the purposes of the hearing. After the hearing and after any studies or investigations conducted by or on behalf of the director as he or she deems necessary, the director shall determine whether a control area shall be designated. If the director determines that no control area shall be established, he or she shall issue an order declaring that no control area shall be designated.

(c) If the director determines that a control area shall be established, he or she shall consult with such relevant state agencies named in subdivision (b) of this subsection and with the district or districts affected and determine the boundaries of the control area, taking into account the considerations enumerated in subsection (1) of this section, the effect on political subdivisions, and the socioeconomic and administrative factors directly affecting the ability to implement and carry out local ground water management, control, and protection.

(d) If the director determines that contiguous area within the jurisdictional limits of one or more districts other than the district or districts which initiated the hearing is subject to the conditions identified in this section and therefore appropriate for inclusion in such control area, he or she shall so notify such other district or districts prior to issuance of the order designating the control area. Such additional area shall not be included in the control area unless any such other district consents in writing to such inclusion within sixty days of such notification by the director.

(e) When the boundaries of a control area have been determined, the director shall issue an order designating the area as a control area. Such an order shall include a geographic and a stratigraphic definition of the control area. Notice of the order shall be provided in the same manner as that provided for the hearing.

(5) Modification in control area boundaries or dissolution of a control area may be accomplished utilizing the procedure established in this section for the initial designation of such areas as control areas, but hearings for designation, modification, or dissolution of such control area may not be initiated more often than once a year.

Source: Laws 1975, LB 577, § 3; Laws 1981, LB 146, § 6; Laws 1986, LB 894, § 22.

46-665. Natural resources district; conduct meeting to determine controls; hearings; when; public notice. (1) Following the designation of any area as a control area and at such other times as the district desires the adoption, amendment, or repeal of any control authorized by section 46-666, the district shall hold a public meeting to determine the type of controls to be imposed within that control area.

(2) Prior to the adoption, amendment, or repeal of any authorized control, the district shall hold one or more public hearings to consider testimony regarding such adoption, amendment, or repeal. The text of the control proposed for adoption or repeal or of the amendment shall be made available to the public at least thirty days prior to any such hearing. The hearings shall be held within or in reasonable proximity to the control area. Public notice of the time and place of all such hearings shall be given in the manner provided in section 46-658.

(3) At the hearing, all interested persons shall be allowed to appear and present testimony. The Conservation and Survey Division of the University of Nebraska, the Nebraska Natural Resources Commission, and the Department of Environmental Control shall offer as evidence any information in their possession which they deem relevant to the purposes of the hearing.

Source: Laws 1975, LB 577, § 10; Laws 1981, LB 146, § 7; Laws 1984, LB 1071, § 7.

46-673.03. Ground water management plan; director; review; duties. The director shall review any ground water management plan submitted by a district to ensure that the best available studies, data, and information were utilized and considered and that such plan is supported by and is a reasonable application of such information. If the primary purpose of the proposed management area is protection of water quality, the director shall consult with the Department of Environmental Control regarding approval or denial of the management plan. The director shall consult with the Conservation and Survey Division of the University of Nebraska, the Natural Resources Commission, and such other state or federal agencies the director shall deem necessary when reviewing plans. Within ninety days after receipt of a plan, the director shall transmit his or her findings, conclusions, and reasons for approval or disapproval to the district submitting the plan.

Source: Laws 1982, LB 375, § 5; Laws 1986, LB 894, § 27.

46-674.06. Special protection area; contamination; not point source; director; duties; hearing. If the Director of Environmental Control determines from the study conducted pursuant to section 46-674.04 that one or more sources of contamination are not point sources, he or she shall, within thirty days after completion of the report required by section 46-674.04, consult with the district within whose boundaries the area affected by such contamination is located and fix a time and place for a public hearing to consider the report, hear any other evidence, and secure testimony on whether a special ground water quality protection area should be designated. The hearing shall be held within one hundred twenty days after completion of the report, shall be open to the public, and shall be located within or in reasonable proximity to the area considered in the report. Notice of the hearing shall be published in such newspapers as are necessary to provide for general circulation within the geographic area at least once each week for three consecutive weeks, the last publication to be not less than seven days prior to the hearing. The notice shall provide a general description of all areas which will be considered for inclusion in the special ground water quality protection area.

At the hearing, all interested persons shall be allowed to appear and present testimony. The Conservation and Survey Division of the University of Nebraska, the Department of Health, the Department of Water Resources, the Nebraska Natural Resources Commission, and the appropriate district shall offer as evidence any information in their possession which they deem relevant to the purpose of the hearing. After the hearing and after any studies or investigations conducted by or on behalf of the Director of Environmental Control as he or she deems necessary, he or she shall determine whether a special ground water quality protection area shall be designated.

Source: Laws 1986, LB 894, § 5.

46-1217. Water Well Standards and Contractors' Licensing Board; created; members; qualifications. There is hereby created a Water Well Standards and Contractors' Licensing Board. The board shall be composed of nine members, five of whom shall be appointed by the Governor as follows: (1) A water well contractor representing irrigation well contractors, (2) a water well contractor representing domestic well contractors, (3) a water well contractor representing municipal and industrial well contractors, (4) a pump installation contractor, and (5) a manufacturer or supplier of water well or pumping equipment. The director or his or her designated representative of the Department of Health, the director or his or her designated representative of the Department of Environmental Control, the director or his or her designated representative of the Department of Water Resources, and the director or his or her designated representative of the Conservation and Survey Division of the University of Nebraska shall also serve as members of the board. Each member shall be a resident of the state. Each appointed member of the board shall have had at least five years of experience in the business of his or her category prior to appointment and shall be actively engaged in such business at the time of appointment and while serving on the board. Each member representing a category subject to licensing under the Water Well Standards and Contractors' Licensing Act, with the exception of members initially appointed, shall be licensed by the department pursuant to such act. In making appointments, the Governor may consider recommendations made by the trade associations of each category.

Source: Laws 1986, LB 310, § 17.

57-904. Nebraska Oil and Gas Conservation Commission; members; qualifications; appointment; term; quorum; vacancy; compensation. There is hereby established the Nebraska Oil and Gas Conservation Commission. The commission shall consist of three members to be appointed by the Governor. The director of the state geological survey shall serve the commission in the capacity as its technical advisor, but with no power to vote. Any two commissioners shall constitute a quorum for all purposes. At least one member of the commission shall have had experience in the production of oil or gas and shall have resided in the State of Nebraska for at least one year. Each of the other members of the commission shall have resided in the State of Nebraska for at least three years. Initially, two of said members shall be appointed for a term of two years each; and one shall be appointed for a term of four years. At the expiration of the initial terms all members thereafter appointed shall serve for a term of four years. The Governor may at any time remove any appointed member of the commission for cause, and by appointment, with the approval of the Legislature, shall fill any vacancy on the commission. The members of the commission shall receive as compensation for their services the sum of fifty dollars per day for each day actually devoted to the business of the commission; *Provided,* that they shall not receive a sum in any one year in excess of two thousand dollars each. In addition, each member of the commission shall be reimbursed for his or her actual and necessary traveling and other expenses incurred in connection with the carrying out of his or her duties as provided in sections 81-1174 to 81-1177 for state employees.

Source: Laws 1959, c. 262, § 4, p. 902; Laws 1979, LB 90, § 1; Laws 1981, LB 204, § 99.

72-302. Mineral rights; who may acquire. Any person, persons or association of persons, corporate or otherwise, desiring to obtain the right to prospect for and develop the minerals or valuable substances upon or in any of the public lands or waters of the state, except oil and gas, may do so under the provisions of sections 72-301 to 72-314. It shall be unlawful to prospect upon or in any of such public lands or waters without a permit or for anyone to interfere with the functions and duties of the state surveys having in charge the investigations of the natural resources of the state. The Conservation and Survey Division of the University of Nebraska at the request of the Board of Educational Lands and Funds shall make investigations and reports concerning state lands.

Source: Laws 1918, Thirty-sixth Spec. Sess., c. 7, § 2, p. 43; C.S.1922, § 5220; C.S.1929, § 72-302; Laws 1943, c. 164, § 14, p. 584; R.S.1943, § 72-302; Laws 1969, c. 592, § 1, p. 2444; Laws 1974, LB 811, § 17.

72-308. **Mineral rights; lease; terms; rights and duties of lessee.** A mineral prospector's lease shall be issued to the highest and best bidder. In cases of potash or other substances, the lease issued shall provide that the royalty shall be not less than five per cent, in addition to the bonus to be determined by the Board of Educational Lands and Funds after examination and report by the Conservation and Survey Division of the University of Nebraska and before leasing. Such minerals or substances shall be set apart in pipelines, tanks or other receptacles, suitable for receiving the same, to the credit and benefit of the state or, at the option of the state and by the approval of the board, the lessee shall pay each thirty days into the proper educational funds of the state, through the county treasurer of the county in which the land is situated, the gross market value thereof in cash. The state shall reserve the right to fully use and enjoy, for tillage or other agricultural use, the area leased for minerals, except such parts thereof as may be necessary for mining and development purposes, and a right-of-way over and across said premises to the place of mining or operating, and for pipelines. The lessee shall pay for all damages to growing crops, caused by such operations, and for the use of the land necessarily occupied. The lessee shall have the privilege of using sufficient water from the premises leased to run necessary boilers and engines incident to and used in the operations of the drills, mines or development of machinery, fixtures and buildings placed on said premises by products covered by the lease, and the right to remove the machinery, fixtures and buildings placed on said premises by said lessee or those acting under the lessee. The state, or its authorized agent, may pay for and retain any structures or improvements sought to be removed by the lessee upon the abandonment, expiration or cancellation of the lease.

Source: Laws 1918, Thirty-sixth Spec. Sess., c. 7, § 8, p. 45; C.S.1922, § 5226; C.S.1929, § 72-308; Laws 1943, c. 164, § 17, p. 585; R.S.1943, § 72-308; Laws 1969, c. 592, § 2, p. 2444.

72-312. **Potash lakes partly on state land; joint operation.** Alkali, potash or saline lakes, ponds or marshes, located partly upon state lands and partly upon private lands, shall be measured, tested and analyzed by the Conservation and Survey Division of the University of Nebraska, who shall report to the Board of Educational Lands and Funds, and the proportion of the area and content belonging to each owner shall be determined from such report. If the state lessees and private owners or lessees are unable to agree for joint operation of such area, no alkali, potash or salines in solution shall be removed from such ponds, lakes or marshes until after thirty days' notice by registered mail to all parties concerned. Any or all parties may then operate by rendering monthly an accounting to the board and by paying to the county treasurer in the county in which the land is located, for the state educational funds, the royalty due the state, as determined by the board; *Provided,* that the state shall, at all times, be permitted to examine the books and methods of bookkeeping with relation to the accounts in which the state is interested, and to furnish, if deemed necessary by the board, assistants to make analyses or for checking the quality and quantity of minerals or substances removed.

Source: Laws 1918, Thirty-sixth Spec. Sess., c. 7, § 12, p. 47; C.S.1922, § 5230; C.S.1929, § 72-312; R.S.1943, § 72-312; Laws 1969, c. 592, § 3, p. 2445.

85-162.03. **State Forester; cooperate with other agencies.** In carrying out the provisions of sections 81-805 to 81-807, 81-809, 81-811, and 85-162.01 to 85-162.05 the State Forester shall cooperate with (1) any agency or bureau of the United States, including but not limited to the Forest Service, the Soil Conservation Service, the Agricultural Stabilization and Conservation Service, the Bureau of Reclamation, the Corps of Engineers and the Bureau of Outdoor Recreation, (2) any agency or bureau of the State of Nebraska or its political subdivisions, including but not limited to the Game and Parks Commission, the Nebraska Natural Resources Commission, the State Fire Marshal, the Department of Agriculture, the Adjutant General, the Department of Economic Development, and the Conservation and Survey Division, and (3) any incorporated municipality of the state or any political subdivision of the state, including but not limited to rural fire districts, natural resources districts and weed control districts.

Source: Laws 1967, c. 585, § 3, p. 1975; Laws 1977, LB 510, § 9; R.S.1943, (1981), § 85-163.04.

85-1,104. **University of Nebraska Institute of Agriculture and Natural Resources; established; administrators.** A University of Nebraska Institute of Agriculture and Natural Resources shall be established at the University of Nebraska-Lincoln, which shall embrace but not be limited to the following divisions or administrative units: (1) College of Agriculture; (2) Agricultural Experiment Station; (3) Cooperative Extension Service; (4) Conservation and Survey Division; and (5) Water Resources Research Institute. The University of Nebraska Institute of Agriculture and Natural Resources shall be headed by a vice chancellor and each division or administrative unit shall have a dean, director, or other chief administrative officer.

Source: Laws 1973, LB 149, § 3; Laws 1987, LB 656, § 5.

85-163. Conservation and Survey Division; creation; duties. There is hereby created the Conservation and Survey Division of the University of Nebraska, which shall include the following state surveys: Soil, geological, water and water power, forest, road materials, and industrial. The Conservation and Survey Division shall perform the duties hereinafter defined:

(1) Survey and describe the natural resources of the state, including soil, water, water power, potash, forests, road materials, and cement;

(2) Study the climate, physical features, geology, and mineral resources of the state;

(3) Study and describe the operations, production, and importance of the leading industries of the state;

(4) Investigate and report upon conservation problems of the state;

(5) Study the water-bearing formations of the state, and assist the citizens in locating water supplies;

(6) Secure and preserve the logs of wells drilled in the state, and preserve specimens from each stratum, member, or formation penetrated in said drillings, and inspect such drillings at any time during their progress, and require the person or persons in charge of drilling or prospecting to submit full data in regard to the specimens and logs of the wells;

(7) Prepare and show lantern slides or pictures, including motion pictures, of the state's resources, industries, institutions and development, to be used for educational and industrial purposes within the state and for publicity purposes without the state, and secure and distribute other educational films and slides in Nebraska for educational purposes;

(8) Compile and record, or publish information with reference to, the state's resources, industries and development, and when called upon so to do by an interested party, investigate and report upon oil, mineral, and gas structures and properties situated outside the state and leases or interests therein or thereon being sold or offered for sale in Nebraska. In cases or propositions wherein said investigations show that mineral, oil, or gas properties are misrepresented, or that fraud is practiced in selling same, their officers or agents shall be notified by the Conservation and Survey Division, and if they continue to so operate the same in Nebraska after said notice is given, the division shall report its findings to the Attorney General for action; and

(9) Serve the citizens as an information bureau in regard to the resources, industries, and development of Nebraska.

Source: Laws 1921, c. 16, § 1, p. 101; C.S.1922, § 6773; C.S.1929, § 85-163; R.S.1943, § 85-163; Laws 1949, c. 314, § 1, p. 1032; Laws 1975, LB 355, § 1.

85-164. Conservation and Survey Division; powers; director; expenses. The Conservation and Survey Division is given police power and authority for the purpose of carrying into effect and performing the duties defined in section 85-163. The Board of Regents shall appoint a chief or director of the division, who shall direct the work of the division, subject to the approval of the regents. All expenses incurred in carrying out any of the provisions of sections 85-163 to 85-165 shall be subject to the approval of the regents of the University of Nebraska, and paid out of appropriations made from time to time by the Legislature.

Source: Laws 1921, c. 16, § 2, p. 102; C.S.1922, § 6774; C.S.1929, § 85-164.

85-165. Conservation and Survey Division; agreements with federal departments. The Conservation and Survey Division may enter into such agreements with federal departments as may be necessary to carry on cooperative surveys and investigations in the state, the agreements to be subject to the approval of the Board of Regents of the University of Nebraska.

Source: Laws 1921, c. 16, § 3, p. 103; C.S.1922, § 6775; C.S.1929, § 85-165.

APPENDIX 2

PAST REVIEWS OF

CONSERVATION & SURVEY DIVISION

RESPONSE

to

CONSERVATION AND SURVEY DIVISION

1989 COMPREHENSIVE REVIEW

REVIEW TEAM MEMBERS:

John Benson, University of Nebraska-Lincoln
Thomas Fenton, Iowa State University
David Lewis, University of Nebraska-Lincoln
Stanley Morain, University of New Mexico
John Sharp, University of Texas-Austin
Robert Weimer, Emeritus, Colorado School of Mines
Michael Barcelona, Illinois State Water Survey

The following is a report to the Conservation and Survey Division (CSD) comprehensive review team which conducted a review of division activities in 1989. The responses below are grouped together according to the categories most often mentioned in the report and will serve not only as a team update but also as a progress report to all interested audiences. Externally, it is a documentation of change and results. Internally, it provides a sense of direction and momentum as the division evolves to serve its varied audiences.

Administration

The review team's report mentioned that *"research and service staff are dissatisfied with the effectiveness of the branch structure and favor a more functional, program-oriented structure..."* (p. 4)

A committee, chosen by faculty and staff, was appointed to study the division administrative structure. The committee's report, which included various options, was discussed in depth at the October 1989 CSD faculty retreat. As a result of this discussion, a new administrative structure was adopted consisting of a director and interim associate director beginning in April 1990. This structure was implemented on an interim basis for one year. In 1991 approval was received for an internal search for a permanent associate director. As a result of this internal search, Duane A. Eversoll was appointed associate director in July 1991. This structure seems to be working very well, and there have been no more suggestions for changes.

Committee Activities: Another significant administrative change has been the establishment of new CSD committees which have been very active. Three committees appointed as a result of the 1990 faculty retreat were the Space Committee, the Outreach Committee and the Information/Computing Committee.

The Space Committee recommended major reorganization to better utilize the physical space available to the division, and these recommendations have been implemented. The changes included consolidating CSD map and publication services into one area and moving the entire sales area to room 104, thus removing the public service activities from the administrative area, creating an administrative conference room and renovating the division's front reception area.

Another internal committee established was the Director Appraisal Discussion Committee whose purpose is to encourage completion of director appraisal forms by all faculty members, review and discuss a summarized appraisal with the director and make specific recommendations. Guidelines were set up in 1989 for three tenured CSD faculty to be elected to this committee on a rotating basis, and the committee has now been active for five years.

Although the administrative structure of the division has not changed, the role of committees has continued to evolve and expand. In 1992, a new and important Strategic

Planning Committee was appointed to guide the division's planning activities. The four faculty members on this committee represent the four major programmatic areas of division activity -- geology, water, soils and remote sensing/geographic information systems (GIS). Besides guiding the division's planning activities, which include developing and following the progress of Action Plans, the committee is used as a "sounding board" by administration when faculty input is needed. The committee provides a liaison between administration and faculty in the programmatic research areas.

CSD Faculty

The comprehensive review team's report mentioned that *"the current CSD staff is comprised predominantly of Nebraska natives and graduates of the state's colleges or universities."* (p. 5) The composition of CSD faculty has changed greatly since the committee's report with the addition of five new faculty members, all educated outside of Nebraska. The new faculty hired are as follows:

(1) Dr. James W. Merchant (Ph.D. from the University of Kansas), remote sensing and geographic information systems (GIS) specialist, joined the division in 1989 and is assistant director in the Center for Advanced Land Management and Information Technologies (CALMIT).

(2) Steven S. Sibray (M.S. from the University of New Mexico), hydrogeologist, joined the division in 1989 in a research and service position in our Scottsbluff office.

(3) Dr. David C. Gosselin (Ph.D. from the South Dakota School of Mines), hydrogeologist, was originally hired in 1989 to staff the Norfolk office in a research and service position and in 1991 Dr. Gosselin was moved to Lincoln.

(4) Dr. Anne Matherne, hydrologist, was hired in 1990 after receiving her Ph.D. from the University of Illinois at Chicago. (Dr. Matherne left the division in June 1995.)

(5) Dr. You-Kuan Zhang, research hydrogeologist, joined the division in 1990 after graduating from the nationally recognized program at the University of Arizona. Dr. Zhang left the division in 1993 for a position involving more teaching. Dr. Xun-Hong Chen, a research hydrogeologist with expertise in quantitative hydrogeology, joined CSD in 1994 from the University of Wyoming.

(5) Dr. Edwin Harvey will join the division in August 1995 after completing his Ph.D. at the University of Waterloo (Ontario, Canada). This position, specializing in Pleistocene geology/hydrogeology, has been a major goal for the division for many years. The attainment of this goal was accomplished with the retirement of Frank Smith, a long-time division faculty member who specialized in water service.

In the review team's 1989 report they noted, *"It is imperative that a competent hydrogeologist succeed the current well design/location contact (F. Smith) prior to his retirement." (p. 21)* The committee report also noted, *"The bulk of the public requests for assistance to the Water Branch are handled by only two individuals. There do not seem to be 'understudies' to sustain or expand the effort to meet continued demand." (p. 10)* With one retirement (Frank Smith), the division requested and received approval to hire two new individuals -- one the research-oriented Pleistocene geologist/hydrogeologist (Ed Harvey), and the other a Water Scientist (Scott Summerside) to handle the water service requests. Thus one additional position was created in the water programmatic area.

These new faculty members, working with older established members of the faculty, have revitalized the division's research program. New, innovative areas of research are being explored, and cooperative interdisciplinary projects with other university departments are being explored.

Planning and Goals

The review team's reported noted that: *"When short- and long-term goals have been identified which are essential to the future viability of CSD, strategies should be formulated to achieve the goals and fulfill the mission shared by IANR of national prominence in agriculture and natural resource institutions by the year 2000."* (p. 15)

Annual faculty retreats are now a regular division activity at which goals and planning are discussed. In fact, the theme of the 1991 faculty retreat was "Can We Get There From Here?" and focused on what the division will be in the year 2001 and the steps needed to achieve the perceived goals. As a result of the retreat, a CSD Strategic Planning Committee was established to oversee the division's planning activities, and this committee, along with the administration and faculty input, are putting together short- and long-term goals for the division.

A great deal of progress has been made in this area. As part of the Institute of Agriculture and Natural Resources (IANR) strategic planning activity, the development of action plans to address goals is now an integral part of the division's planning process. For the period 1989-92, the division established five action plans: (1) a program to provide statewide leadership in Geographic Information Systems (GIS) technology; (2) automation of CSD data sets; (3) enhancement of the CSD outreach program; (4) aquifer characterization studies; and (5) geology of the Nebraska Sand Hills. The following action plans were established by the CSD Strategic Planning Committee after consultation with faculty for the period 1992-95: (1) Acquisition of Natural Resources Data; (2) Integrated Hydrologic Systems Research; (3) Automation of CSD Data; (4) CSD Educational Services; (5) CALMIT's Role in Water Resources Assessment; and (6) Regional and Global Landscape Characterization. The Strategic Planning Committee is currently updating and revising these 1992-95 action plans to cover the next three year planning period.

Extramural Funding

The comprehensive review team's report mentioned that *"a significant decrease in external funding for research has occurred over the past three years."* (p. 11) In the past five years, this trend has been reversed. In FY 1989-90 extramural funding (total project funds for any new project begun during that time period) was $412,000. By fiscal year 1991-92 extramural grant funding had doubled to $865,000. Extramural funding for the next three fiscal years was: FY 1992-93 - $1,263,000; FY 1993-94 - $1,306,000; and FY 1994-95 - $1,073,000.

One of the long-term goals of the division is to achieve an on-going level of extramural grant funding to match the $2 million state appropriation. However, it may not be possible to achieve the goal suggested by the review team's report that *"tenured research staff should generate at least one proposal for extramural funding per year if they are not at least 50% involved in an ongoing research effort."* (p. 16) Some faculty are involved in geological mapping and survey activities which may not lend themselves to extramural funding. However, through the Association of American State Geologists (AASG) the director was involved in helping the U.S. Congress to pass the National Geologic Mapping Act in 1991 (H.R. 2763) which has provided extramural funding for basic ongoing survey and mapping activities.

Another comment in the report concerning extramural funding was that *"overhead or indirect cost returns to CSD which issue from the externally funded activities are not returned to these groups in a tangible fashion."* (p. 11) In September 1991, $10,000 was returned to CSD based on research grants funded during FY 1990-91. However, since that time the university has revised its policy of returning overhead monies to the units generating the grants. Established in 1992, the policy now is that 50 percent of the overhead costs are returned directly to the university deans, with the remaining amount used to support research-related activities. These returned funds are to be used to enhance research and scholarly activities. Since this policy went into effect, in 1992 the division received $34,900, in 1993 $55,000, and in 1994 $64,800 in returned indirect costs. The CSD director, in turn, allocates two-thirds of these returned funds back to the project leaders whose grants generated them. The remaining one-third of the returned indirect cost funds are used to pay for division-wide equipment and other needs. This new policy has provided an incentive for faculty members to increase their extramural grant funding.

Communication

One of the most frequently mentioned areas for improvement in the division was communication, both internally and externally. A great deal of progress has been made in both these areas.

Internal communication among faculty in all program areas has greatly improved. Annual faculty retreats and monthly faculty meetings give everyone ample opportunity for interaction and exchange of ideas. The arrival of new faculty members has greatly increased research cooperation and interaction. One new service which has greatly improved internal

communication has been the advent of e-mail. All division staff members now have access to a computer, and all have electronic-mail capabilities. Much internal CSD communication (announcements of meetings, committee reports, requests for information, etc.) are now handled through e-mail. Thus, faculty are kept better informed on activities and issues, turn-around time on requests for information has improved, and the consumption of paper has decreased.

The review team's report suggested that *"it would be most beneficial to begin a series of staff research seminars."* (p. 16) Such a series was instituted in 1991 during the winter months of January - April when many CSD faculty members presented seminars for CSD faculty and staff as well as for other interested University faculty. These seminars were very successful and have been continued in the years since.

Tenured faculty members of the Promotion and Tenure Committee have also established an informal "mentoring" program for new faculty members on tenure track. Activities of tenure-track faculty are annually reviewed by this committee and suggestions for activities to promote tenurability are made. Informal individual mentoring activities have also increased. Mary Spalding achieved tenure in 1991, Jerry Ayers in 1992, and in 1995 three faculty members received tenure -- David Gosselin, Mark Kuzila and James Merchant.

A great deal has also been accomplished with regard to external communication. The review committee's report suggested that *"a sign for CSD should be placed on Nebraska Hall"* (p. 5), and this has been accomplished.

Closer affiliation between CSD faculty and those in other departments has been established. For example, many CSD faculty now have courtesy appointments in other departments, and courtesy appointments in the Conservation and Survey Division have increased to eight in the State Museum and the departments of Geology, Agronomy, Geography and Forestry, Fisheries and Wildlife.

In the area of external communication (outreach), activities have continued to grow. The most important accomplishment has been the establishment of a CSD Outreach Committee as a result of the 1990 CSD faculty retreat. Committee accomplishments have included: (1) development of a directory of CSD personnel, expertise and services which will be made available to the general public to promote the division; (2) implementation of a quarterly 4-page CSD newsletter, *Resource News,* which supplements the annual report of CSD activities, *Resource Notes*; and (3) working with the Department of Geology, the UNL Teachers College and the State Department of Education to establish a Nebraska Earth Science Education Network (NESEN) to promote earth science education in the secondary schools.

The activities of NESEN have grown rapidly in the past four years. The division has now obtained a $100,000 grant to hire a NESEN coordinator and for a pilot project to extend computer Internet capabilities to seven schools in Nebraska as well as distribute earth-science educational materials over the network. NESEN has developed a membership directory, a

quarterly newsletter and summer workshops for teachers. This activity has increased the visibility of the division as a resource for science teachers and students.

In 1993, the division celebrated the centennial anniversary of the State Geological Survey. Centennial activities included the following: (1) a seminar series featuring three nationally known speakers focusing on teaching, research and service in the earth sciences area; (2) a dignitaries luncheon for over 100 state, federal and university officials during which the Nebraska Governor's office presented a proclamation making the week of September 19-25, 1993 Nebraska Geology Week; and (3) an open house featuring CSD offices in Nebraska Hall attended by over 400 people. The open house featured displays on virtually every aspect of CSD's mission and history. The wall murals remain on display today. This open house provided an opportunity to showcase division activities to a wide audience and increase its visibility.

Publication Output

The review team report recommended that *"it would be most favorable to renew the publication of the CSD cornerstone (i.e., peer-reviewed quality) publication series."* (p. 18) This recommendation has been implemented with the establishment of the CSD Professional Paper Series. The criteria for this new CSD series of peer-reviewed publications is: (1) papers should reflect original, high quality scholarship; (2) the research should be related to the CSD role and mission; and (3) the work must not have been published elsewhere.

A CSD Editorial Board has been appointed consisting of five members: three tenured CSD faculty (including one member of the Promotion and Tenure Committee), one tenured faculty from IANR (other than CSD), and one tenured faculty from another UNL unit. The purpose of the Editorial Board is to oversee the peer-review process with outside reviewers. The first paper of this professional series was published in 1993: *Taxonomy, Paleoecology and Biostratigraphy of the Crinoids of the South Bend Limestone (Late Pennsylvanian-Missourian, & Virgilian)*, by Roger Pabian.

The automated graphics capability of the CSD cartographic and publication staff has been enhanced with the purchase of up-to-date software and hardware which has increased the efficiency of the publication support staff.

New Facility

The review team's report noted that *"the Lincoln facilities of the CSD are inadequate for the minimal traditional legislated mission activities of the CSD. New initiatives, particularly those which depend in part on specialized facilities, are distributed in too many buildings and areas within Nebraska Hall to facilitate active staff supervision and interaction."* (p. 5)

The director has long had a goal of consolidating all CSD operations into one building, and in 1991 he was appointed to chair an IANR Natural Resources Facility Committee to

begin the planning process for such a building. The building proposal would consolidate nine different programmatic units and one federal agency that are scattered in 19 different buildings around the UNL city and east campuses. These units are: Conservation and Survey Division; Department of Forestry, Fisheries and Wildlife; Nebraska Forest Service; Department of Agricultural Meteorology; Environmental Programs; Water Center; Nebraska Statewide Arboretum; and the Departments of Geology and Geography. The inclusion of the last two departments from city campus is a major change from the last time a Natural Resources Building was proposed, and would greatly enhance the interaction, cooperation and interdisciplinary activities between these units and the division. This proposal was not successful; however, planning money for a new facility has been added to the university's budget.

Since that time, various committees have been appointed to study the issue and the related issue of natural resources programs in the Institute of Agriculture and Natural Resources. The latest proposal for a School of Natural Resources/Environmental Sciences to be housed in a new facility will be discussed and debated by a faculty committee yet to be appointed.

Database Automation

The comprehensive review team's report noted that *"very little of the vast amount of geologic data collected has been entered into machine-readable form. This fact minimizes the access to the data for corporate, public and research purposes."* (p. 7)

The report also noted that *"the water quality and quantity databases which have been collected are quite large and unique in the midcontinent agricultural states. The database is largely maintained as hard copy or by individual investigators on microcomputers. The value of this data cannot be fully realized for the CSD research and service programs in this form."* (p. 10)

The automation of CSD databases is a high priority goal of the division and was one of the division's major action plans for the period 1992-95. It became obvious that reassignment of current staff would be necessary to fully implement an automation process. This reassignment began in 1992 with the reclassification of an office/service Clerical Assistant III position (Duane Mohlman) to a managerial/professional level Data Systems Coordinator. Also, another grant-funded clerical position was created to assist in data entry, and one student has been working on this project for two years.

Many of the division's databases have been automated and are used to produce statewide, computer-generated maps. These include: oil and gas wells, earthquakes, landslides, land use, lakes, major roads, mineral operations, nitrates in wells, natural resources district (NRD) boundaries, center-pivot irrigation systems, railroads, registered wells, roads, range and township, sections, streams, soils, test holes, topography, towns, watershed boundaries, water levels and many more. The division averages about four requests per week for computer-generated maps. Some examples of recent requests include: (1) The City of Gothenburg was preparing a community grant and needed to know how many center-

pivot systems were located within a 50-mile radius of the community. (2) An engineering consultant needed to know the locations of all registered wells west of the Blue River in Seward County, together with a 1,000-foot exclusion zone around each well. (3) Many natural resources districts have requested specific computer-generated maps as they develop their groundwater management plans.

Much more remains to be done, especially related to the water quality and quantity databases. The addition and filling of the Assistant Geoscientist (water service) position with Scott Summerside in 1993, has provided someone knowledgeable about automation of the division's huge store of water files, and it is hoped that this effort will come to fruition in the near future.

Tenure Question

Because of the division's unique position within the University system, the question of tenure for faculty continues to be a concern. However, as noted previously, division faculty members have been successful in achieving tenure, i.e., Mary Spalding was granted tenure in 1991, Jerry Ayers in 1992, and Dave Gosselin, Mark Kuzila and Jim Merchant were granted tenure in 1995.

The review team's report noted that *"the diverse activities, 'products,' and client groups of the CSD place the scientific staff in an uncertain position within the University tenure system. The applied nature of the research, the variety of service 'products' and unique instructional activities of the staff result in confusion among tenure-track staff as to applicable standards for achieving tenure."* (p. 5)

It was recognized that this was a problem across IANR, and in 1990 the director was appointed to an IANR ad hoc committee to develop criteria for evaluating faculty members with service appointments. The committee developed a definition of a new type of "scholarly service" appointment in IANR. Scholarly service within IANR is defined as "the generation, collection, archiving and dissemination of data and information and/or the training of individuals, private groups or governmental agencies either within or outside of UNL which are not considered to be extension or continuing education activities." The committee then developed a set of criteria for evaluating faculty members with scholarly service appointments.

These criteria and the "scholarly service" appointments have been adopted by IANR, and the division is revising the position descriptions of various faculty members to reflect the scholarly service content. This should make tenure and promotion easier to obtain.

In their 1989 report, the review team's report noted that *"It is equally important to insure that 100% service staff are afforded non-tenured (equivalent rank) status through a well-defined process."* (p. 16) We are pleased to report that this has been accomplished. At the September 30, 1994 meeting of the University Board of Regents, they approved an equivalent rank system for selected positions in the division.

In this equivalent rank system, selected scholarly service oriented faculty and managerial/ professional positions in the division, such as those in field offices and certain positions in Lincoln, were converted to equivalent rank, non-tenure track faculty positions. Four (Scott Summerside, Susan Lackey, Steve Sibray and Limin Yang) were converted to equivalent rank of Assistant Geoscientist in early 1995. All of these scholarly service positions are primarily designed to serve the public. The designation of such positions as equivalent rank, non-tenure track, will allow the individuals who fill these positions to provide scholarly service in accord with a defined research role, but without the stringent level of research productivity required for tenure.

A specific list of criteria for promotion was developed for the equivalent rank system from Assistant Geoscientist to Associate Geoscientist to Geoscientist. The participants in this system will be reviewed annually by the CSD Promotion and Tenure Committee for their progress toward promotion through this system.

Program Areas

While the above comments relate specifically to suggestions or recommendations raised in the review team's report, the following update on CSD program areas provides information on new projects and activities in geology, hydrogeology, soils and CALMIT since the review team's 1989 visit.

The state and the division are facing a number of challenges, especially in environmental areas. High on this list is waste disposal, both new sites and concerns about the current facilities. Over 300 unlicensed solid waste dumps have been identified across the state. Major state regulatory activity will require technical back-up from the division. Nebraska was also chosen as host state for the first low-level radioactive waste facility within our compact. A license application was filed for an above-ground concrete vault structure. The division has management responsibility for review of the technical characteristics of the proposed site, and 23 technical reviewers are involved. As in other compacts, these technical and regulatory considerations are accompanied by continuing political concerns.

Geology. The North Platte 2 degree geologic quadrangle has been completed and approved by the USGS for publication. Work continues on the Broken Bow, O'Neill, Valentine and Alliance 2 degree quadrangles. The Morrill County COGEOMAP 1:62,500 geologic map was completed and submitted during 1992. The Scotts Bluff 2 degree quadrangle was submitted in 1994. Postcard and page-sized geologic bedrock maps of Nebraska have been published.

Several stratigraphic, sedimentologic and paleontologic studies are completed and have either been published or are in press. Environmental geology studies include publication of an updated Earthquakes of Nebraska and a report on Landslide Inventory Along Nebraska State-Federal Roadway System. Sets of notes ("Nebraska GeoNotes") on numerous geologic topics have been prepared for distribution to the general public.

Hydrogeology. The new professional staff added in the areas of stochastic modeling and groundwater-surface water interactions will be key to research efforts to understand contaminant movement in the groundwater system and some of the complex hydrogeologic relationships along Nebraska's rivers. The action plan on Integrated Hydrologic Systems in Nebraska has focussed the work of this group of researchers to understand the physical, chemical and biological interactions that occur as water moves through the various parts of the earth's hydrologic cycle.

The division continues to be involved in modeling in both the Upper Republican River area and in the southern Sand Hills. Continuing projects include modeling contaminant flow in the vadose zone, studies of groundwater resources in fractured aquifers, and water quality in northeastern Nebraska. Extensive studies of groundwater/surface water interactions along the Platte River, especially in the area of municipal well fields, are important to the state.

Soils. The Nebraska Department of Revenue and county assessors use soil survey information in the tax-equalization process. This process is one of the main reasons for the transition of the soils program from the completion of "modern" soil surveys to the steady collection and dissemination of up-to-date soils information. Modern soil surveys have been published for 86 counties, 7 counties have completed soil surveys awaiting publication. A full-color 1:1,000,000 general soil map of Nebraska was published late in 1990.

Research on morphology of buried soils and the mineralogy of soil parent materials is in progress at sites in Clay, Franklin, Garden and Valley counties. Division soil scientists are also currently involved in research related to water movement, water quality, the unsaturated zone and waste disposal. Regional soil studies within Major Land Resource Areas 72 (southwestern) and 106 (southeastern Nebraska) are also a part of the current division soils program.

CALMIT. As a center of excellence, the Center for Advanced Land Management Information Technologies (CALMIT) serves to focus the significant interdisciplinary expertise in this area that exists on campus and in the region. CALMIT research emphases include: (1) field spectroradiometry focussed on observations of surface water; (2) remote sensing of aquatic and wetland ecosystems; (3) analysis of AVHRR data for continental and global land-cover characterization; (4) spatial and contextual analysis of digital multispectral imagery; and (5) expert systems in remote sensing and geographic information systems (GIS).

During 1993 CALMIT was relocated to new, spacious quarters. The facility includes a reception area, training room, four offices, computer room, data-storage room, and computer-user room. CALMIT staff provided several training courses on GIS and remote sensing during the past year. The many participants represented various agencies and academic departments from as far away as Pakistan and Iceland. CALMIT offers short courses in GIS, advanced GIS, digital image processing, and remote sensing/GIS for water resources assessment. Opportunities for satellite tele-instruction are being explored. CALMIT also has instituted a visiting scientist program, and the first visiting scientist is a researcher from China.

COMPREHENSIVE REVIEW OF THE CONSERVATION AND SURVEY DIVISION

A REPORT

By

Mr. John Benson (University of Nebraska - Lincoln)
Dr. Thomas Fenton (Iowa State University)
Dr. David Lewis (University of Nebraska - Lincoln)
Dr. Stanley Morain (University of New Mexico)
Dr. John Sharp (University of Texas - Austin)
Dr. Robert Weimer (Emeritus - Colorado School of Mines)
Dr. Michael Barcelona (Illinois State Water Survey) - Chairman

Submitted to

THE ADMINISTRATION OF THE INSTITUTE OF AGRICULTURE AND NATURAL RESOURCES

UNIVERSITY OF NEBRASKA-LINCOLN

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I. Charge to the Committee

The review committee was charged with the task of a comprehensive, forward-looking review of the Conservation and Survey Division (CSD) of the Institute of Agriculture and Natural Resources (IANR) at the University of Nebraska-Lincoln. The review was to have been conducted with an emphasis on the future directions which the CSD may take and how it can best plan to meet future challenges. In addition, the review team was asked by the IANR administration to focus on the relationships of the CSD with other IANR units within the context of the Institute's Strategic Planning process.

The committee was composed of the following individuals:

Mr. John Benson; Director, Institutional Research and Planning; Assoc. Prof., Dept. of Architecture - University of Nebraska - Lincoln (Academic Planning Committee Monitor)

Dr. Thomas Fenton; Prof., Dept. of Agronomy - Iowa State University

Dr. David Lewis; Prof., Dept. of Agronomy - University of Nebraska - Lincoln

Dr. Stanley Morain; Director, Technology Application Center; Chairman, Department of Geography - University of New Mexico

Dr. John Sharp; Prof., Dept. of Geological Sciences - University of Texas - Austin

Dr. Robert Weimer; Prof. Emeritus, Dept. of Geology - Colorado School of Mines

CHAIRMAN - Dr. Michael Barcelona; Head, Aquatic Chemistry Section, Water Survey Division, Illinois Department of Energy and Natural Resources, University of Illinois - Urbana-Champaign

II. Conduct of the Review

The review was conducted from May 1 through May 4, 1989 on the UNL campus. Prior to the review dates the committee members received the Conservation and Survey Division's Self-Study Document dated April, 1989 to familiarize them with the past, present and prospective activities of the Division. The Self-Study Report also contained information on administrative structure, staff composition, physical facilities, branch goals and needs. The committee also requested and received a more detailed breakdown of overall CSD funding and sources during the past nine years as well as a listing of current project summaries.

The review sessions consisted mainly of scheduled individual meetings with the faculty and chiefs of the CSD branches in which the points contained in the Self-Study Document were presented along with highlights of specific research, service and teaching activities of the staff. The committee had opportunities to meet with: the heads of UNL departments which collaborate with the Division, the representatives of state and federal agencies which cooperate with it, and with the members of the recently-formed CSD Advisory Council. This Council is comprised of representatives of CSD's major constituent groups.

The meetings were scheduled tightly over the three-day period with the evenings left open for committee deliberations. CSD staff, the Self-Study Task Force, and the Director of the Division, Dr. Perry Wigley were most helpful in facilitating the review process. The committee was afforded all the available information necessary to conduct the review in a timely, efficient manner.

III. Major Findings of the Review Committee

The committee's initial impression was that the review and its draft report could be completed within a three-day period. The sheer breadth and variety of CSD activities, together with its unique relationship to the academic community, state government and the public, required virtually the entire review period to be spent on information-gathering.

The committee found that the CSD is a well respected, technically capable unit of the IANR and a valuable resource to the State of Nebraska. It was clear that the CSD's long history of service, survey (data collection) and research provides a basis for a fruitful present and future. Further, the depth of collaborative activities, which were only discussed briefly in the Self-Study Report, underscores the need for a careful reexamination of current program goals and priorities.

It is in this context and the need to enable CSD to meet the future effectively that the committee presents its major findings and the recommendations. The review was one of the Division rather than of the Director, individual faculty or staff.

A. Division Administration and Support Branch

Administration

The Division is divided into three branches each headed by a chief who reports to the Director. A separate administrative and support group reports to the Director through the Assistant to the Director. The Water Branch has operated for the past two years without a chief. The current Director has served in this interim capacity due to the lack of branch consensus on an individual to serve as water branch chief.

- The staff is technically capable, enthusiastic, and proud of their contributions within the Division. In most cases, the staff members are concerned about their professional development. Such development is encouraged by the Director.

- The communication between the branch chiefs and the Director seems to be open, direct and works reasonably well with respect to the current activities of the CSD. Communication between the branches and the faculty's understanding of CSD budget finances, overall goals, project planning and execution could be improved. Project-level scientific interaction is apparently inhibited by the branch structure.

■ New natural resource problems have become apparent and increasingly important in the past two decades. The current Director recognizes their importance, particularly in the geologic, water, soil, geographic information systems (GIS), and Center for Advanced Land Management Information Technologies (CALMIT) resource areas. He has actively promoted these and other CSD activities in the past two years. There is evidence that more emphasis must be placed on these and other critical areas from the point of view of CSD policy and administration to encourage interdisciplinary work. The branch structure may have stalled the development and execution of interdisciplinary efforts on critical resource problems. However, since the Water Branch has not had a full-time branch chief, the system may not have had a chance to work as designed.

■ Research and service staff are dissatisfied with the effectiveness of the branch structure and favor a more functional, program-oriented structure rather than one formed on disciplinary lines. Important research opportunities may have been missed under the existing structure. Also scientific staff morale may be ebbing somewhat as a result.

■ CSD activities are focussed on geological, water, soil and information (data repository, publications, GIS and CALMIT) resources. The CSD, therefore, represents a type of "Center" within the IANR-UNL system. The "Center" concept has served CSD well within academic circles and to some extent in its government and public activity areas. It is clear that after nearly 70 years of operation, the overall mission of this valuable state entity needs to be reexamined in the light of emerging areas of applied research and service need. The CSD, therefore, represents an example of a "mature" Center within the University system. The process of CSD mission reexamination and strategic planning may serve as a model for periodic evaluation of other UNL Centers.

■ Substantial expertise, capability and enthusiasm exist within the CSD which can serve as a basis for the emergence of a "Center" with a renewed mission, goals and strategy.

■ The CSD is well-funded to carry out the traditional aspects of its legislated mandate in comparison with other groups which are represented in the Association of American State Geologists. The pressure to pursue critical new research, service and information-related (i.e., publication, data repository and GIS) initiatives has strained the current level of funding from state and local sources. This funding has been comparatively static over the past nine years. External funding indicators (i.e., number of sources and amounts) have declined substantially in the last three years. The full realization of important research, service and

information objectives in the future will depend on increased external funding.

■ The Lincoln facilities of the CSD are inadequate for the minimal traditional legislated mission activities of the CSD. New initiatives, particularly those which depend in part on specialized facilities (i.e., laboratories, instructional work areas, modern data handling, storage and retrieval capability) are distributed in too many buildings and areas within Nebraska Hall to facilitate active staff supervision and interaction.

■ The lack of external visibility is a problem, particularly with respect to public service activities. A sign for CSD should be placed on Nebraska Hall coupled with good directions to CSD's offices.

■ The diverse activities, "products" and client groups of the CSD place the scientific staff in an uncertain position within the University tenure system. The applied nature of the research, the variety of service "products" (i.e., public consulting, maps, guides and resource evaluation) and unique instructional activities of the staff result in confusion among tenure-track staff as to applicable standards for achieving tenure. This confusion diverts the energies of many individuals. The lack of appropriate tenure expectations further closes off opportunities to develop CSD's future leaders within the institution.

■ The salaries of CSD faculty are low compared to those in comparable UNL academic disciplines. They are particularly low as compared to salaries among scientists in the groups with which CSD must compete for recruits (i.e., other state surveys, private consulting organizations and federal government agencies).

■ The current CSD staff is comprised predominantly of Nebraska natives and graduates of the state's colleges or universities. This reflects the staff's strong commitment to the stewardship, promotion and conservation of the state's natural resources. It may also be a reflection of the relatively low project support and salary levels.

■ There is an indication that a portion of the staff is confused as to the distinction between applied research and service activities. A redefinition of these aspects of the CSD's overall mission would be a necessary part of the process of reexamination of the CSD's goals and the strategies to sustain them. This symptom seems to have significant implications for both resolution of the confused tenure situation and a more general recognition of what can be accomplished with existing facilities and support levels. No doubt this type of blurred distinction

(i.e., applied research vs. data collection/service activities) exists within the extension units of IANR, as well.

■ The short- and long-term branch goals described in the Self-Study Report lack the administrative coordination necessary to insure consistency, balance and focus with overall CSD goals. The administration, together with the branch chiefs, must work out a renewed mission for CSD with reasonable goals and strategies to attain them.

Support Branch

■ The staff of the support branch generally accepted the current administrative structure. It was obvious that the majority of the scientific staff appreciate their efforts to aid in the preparation of CSD "products."

■ It is apparent that many of the staff in this group have multiple responsibilities. For example, administrative assistants or clerical people responsible for typing or filing also handle fiscal duties and accounting.

■ The group is quite productive, given its size and the number of diverse tasks assigned to each individual. This is particularly true of the editing, report production, computing and field operations.

■ Mass data storage, handling, graphics and map preparation tasks are managed largely by labor intensive methods. It must be stated that the ingenuity, creativity and energy of the individuals involved are largely responsible for the considerable productivity of the group.

B. Geology Branch

The Geology Branch represents the core of the traditional focus of the CSD and is currently at the peak of its staffing levels over the past several decades. Several state, academic and corporate groups indicated that the geological data repository, numerous geologic investigations and compilations achieved by the CSD have great value to them and their constituent groups.

■ The principal geological research efforts on the geology of Nebraska are conducted by CSD and as such these activities have a valuable, immutable character.

■ Major service-oriented activities of the group include geological sample and data repository, test-drilling and geologic mapping which have achieved an impressive, large body of data on surface and subsurface geologic conditions in Nebraska.

■ Valuable research opportunities have been encountered during the course of the above activities. Published reports are available for industrial use towards the discovery and production of energy and other mineral deposits.

■ Public information efforts and materials (i.e., maps, field guides and guidebooks) have been well-prepared and appear to be in wide distribution.

■ The output of scientific academic and lay-person written products have dropped off substantially from pre-1980 levels in the past decade. (Judging from the CSD Publications Guide -- April 1989) Other indicators of productivity, such as public contacts, advice and mapping activities are difficult to gauge, although the number of service contacts recorded have been increasing in recent years. Approximately 20% of the publications from this branch in the last ten years would be considered as being peer-reviewed journal quality.

■ Given the importance of the water and soil resources of the state to its future economic vitality, the CSD resources apportioned to the geologic test drilling effort seem to be excessive in the opinion of the majority on the review team. At the very least, more emphasis needs to be placed towards better coordinating geologic activities with those in water and soil.

■ Very little of the vast amount of geologic data collected has been entered into machine-readable form. This fact minimizes the access to the data for corporate, public and research purposes. It further requires the dedication of a relatively large amount of space for paper files.

■ The scientific goals for the sustained test drilling activities and more detailed scale mapping efforts were not evident to the committee.

■ The CSD has done only limited work in either engineering geology or environmental geology. More emphasis on these activities is needed now as it will be in the future.

■ The repository of geologic samples from the test-drilling and cooperative drilling programs is immense and represents a unique, valuable archive which is irreplaceable. Some of these samples, though they only are catalogued in paper records, may prove very useful to future service

and research activities. The repository seems to be underutilized in support of current CSD research activities.

■ Contact between this branch and the UNL Geology Department is minimal. The two groups should have common interests in Nebraska geology.

C. Geographic Information Systems and Soil Branch

This branch within CSD is the most varied with respect to the number of major staff disciplines represented, the extent of their academic teaching and advisory involvement, and their research and service (i.e., data management, public interaction) involvement. This branch also has the most extensive collaboration with IANR and UNL extension and academic units. The units within this branch are sufficiently different in principal activities that they merit specific findings and recommendations.

Soils Unit

■ The second series of soil surveys and maps has nearly been completed for the state. At the present time only four counties have yet to be surveyed as a result of the Accelerated Soil Survey Program initiated in 1973. By 1993 these will be completed. This is a notable accomplishment among mid-continent agricultural states.

■ The unit has been planning for the transition from accelerated soil mapping to the collection, verification and dissemination of this valuable information.

■ The preceding accomplishments have been sustained in recent years by virtue of extensive cooperation and co-funding from federal Department of Agriculture - Soil Conservation Service, state and local agencies. Some of these cooperative efforts are informal, while others require detailed written interagency agreements. It is clear that some of these agreements are quite dated.

■ The results of the soil surveys, other than maps, mainly reside in hard copy rather than machine readable format. Like the results of the test-drilling and geologic mapping activities in the Geology Branch, the lack of ready data retrieval methods represents a significant obstacle to important future service and research initiatives.

CALMIT

This unit of the GIS/Soils branch was created in October, 1986. The unit embodies the use of advanced computer and satellite technologies in geographic information systems, digital image processing, remote sensing, automated cartography, and computerized earth sciences' data collection, storage, processing, and retrieval. Through the CALMIT affiliates program, this unit significantly enhances cooperation and collaboration with a wide variety of academic, government and public entities. It is truly an exciting enterprise which must be nurtured.

- The current GIS and remote sensing projects of the unit have only begun to pursue the potential service, research and instructional possibilities of CALMIT facilities.

- In order to achieve its full potential within CSD, CALMIT will require that the very valuable CSD databases are placed in machine-readable form.

- The largest number of peer-reviewed publications in this branch have been prepared by the CALMIT group staff.

- CALMIT has outgrown its present facilities. The space problem will be exacerbated by the continued success and expansion of its activities. It is disfunctional to have CALMIT activities located in several different levels and locations in Nebraska Hall. As a result, major identity and image problems have arisen for the unit.

Computing Unit

This unit provides services for staff use of mainframe and microcomputers, as well as centralized word processing support.

- This unit is functionally more closely related to the Support group than to the other units within the GIS/Soils Branch.

- The staff of this unit has sustained its productivity and apparently high level of support, despite the dated nature of the available hardware and software.

D. Water Branch

This branch also has a number of various disciplines represented in its staff, including chemists, geologists, hydrogeologists, hydrologists,

and technicians. It has a very active long-term water chemistry program which has been largely funded by external support. Ongoing research efforts in hydrological modeling and geophysical applications to hydrogeology are conducted in this branch. This group has been involved increasingly in advising the public, and private well owners in particular, on the best course of action to secure and protect high quality potable water supply. Branch staff members have close teaching and research ties to a number of academic departments. This is reflected in a high percentage of peer-reviewed quality publications in their vitae.

- The research programs in this group have grown on external funds in response to national and state concerns over water quantity and quality. There is a recognition of the need for more CSD support for these efforts.

- The frequency of service requests for this group has increased by approximately 20% over the past five years. This is substantially higher than the level of requests in the other scientific branches. Indeed, the water branch handles more than 70% of the total requests which call for senior staff time.

- The inability to select a branch chief for the past two years coupled with the continued vacancy in two positions seem to have delayed expansion of the branch activities. Morale is fairly low in this branch as the staff feel that water-related activities are being moved to the Water Center. The demand for the service and research work may be expected to continue to increase in the next decade.

- Water is a vital resource base in Nebraska's future. The water quality and quantity databases which have been collected are quite large and unique in the mid-continent agricultural states. The database is largely maintained as hard copy or by individual investigators on microcomputers. The value of this data cannot be fully realized for the CSD research and service programs in this form.

- The laboratory facilities for the water chemistry research efforts are fragmented and are maintained nearly entirely on external funds. The move of some of the laboratories to new facilities in the Water Center may reduce CSD analytical capability below the level needed for support of the service efforts, since the Water Center's primary emphasis is on research.

- The bulk of the public requests for assistance to the Water Branch are handled by only two individuals. There do not seem to be "understudies" in the branch to sustain or expand the effort to meet continued demand.

- It is not apparent that the geophysicists, geologists and hydrologists in the group have extensive interactions with the staff of the Geology Branch or in the UNL Geology Department. Their disciplinary similarity would argue for more frequent, close interaction beyond the participation in the test-hole drilling program.

- The value of the geophysical research effort is growing. It is apparent that there are immediate applications in water quality, water quantity and surface water -- ground water interaction problems. These techniques are not currently considered as a means to extend the data collected in the test-hole drilling program.

- The opportunities and needs for more CSD faculty involvement as instructors and advisors in Geology, Agronomy and other UNL academic units will continue to expand as other groups begin water quality and quantity research efforts.

- IANR extension activities which promote "awareness" of water quality conditions create a substantial demand for senior staff time and analytical support which cannot be met if current programs are to be maintained.

- Overhead or indirect cost returns to CSD which issue from the externally funded activities are not returned to these groups in a tangible fashion. This may act as a disincentive to further grant and contract research efforts, since the staff does not seem to understand CSD budget realities.

E. Cross-Cutting Issues

- The CSD is a well-regarded, academic and government unit which provides an excellent basis for a variety of future scientific activities. It must be well prepared to assume a place of importance in the IANR's strategic planning process.

- A significant decrease in external funding for research has occurred over the past three years. The increasing ties between UNL academic units and the CSD principal investigators involved in "soft-money" projects have resulted in a "drift" of active senior staff away from CSD facilities and support. The risk to CSD as a result of this trend should be obvious.

- There seems to be good balance between CSD research and service functions in the GIS/Soils and Water Branches. There is obviously some

confusion on the part of junior staff as to what applied research is as opposed to data collection activities. Nonetheless, there are very productive interactions between the service and research activities which spark new research ideas and provide the basis for responsive, future service efforts.

- Given the importance of water and soil resources to Nebraska, it was somewhat surprising that the continuing drought of '88 and '89 was hardly mentioned in the context of current CSD research and service activities. The committee was made aware of various external agency concerns and the Director's involvement in the NDOA Moisture Situation Committee.

- Relationships with Division Advisory Council, government and campus groups have been mutually beneficial and it is clear that the demand for more extensive research interaction, deeper service involvements and instructional opportunities will be expanding in the future.

- The CSD's external and UNL collaborators continually stressed the importance of research and service in the soil and water quality areas.

- The CSD fulfills a valuable niche as an unbiased source of technical information and interpretation to the state of Nebraska. On this basis alone it is in the right position (i.e., with respect to capabilities and placement within IANR) at the right time. It can best continue to serve in this role if it maintains its relative administrative autonomy as a division within IANR. It would be a mistake to subsume the CSD into either the university or state organizational structure.

- It was surprising that the state's Department of Environmental Control (DEC) was not represented on the CSD Advisory Council. The water quality information and other needs of the DEC have increased CSD's public prominence and respect in the state. This increased visibility should not be taken as a passing trend.

- The committee found the Self-Study Report to be an inward-looking document for the future which could aid in the strategic planning process. In some cases, the future goals were stated as branch "wish-lists" which did not have clear connections to branch-related initiatives in other groups or to strategies by which the goals could be achieved.

- The Self-Study Report contained little emphasis on the future needs of external groups or the future demands of issues arising outside of CSD.

- The confused expectations which exist in the Division with respect to achieving tenure aggravate recruitment and retention efforts, divert

the energies of the staff and close off CSD from developing its leadership team for the long-term.

- The committee had the impression that project level interactions between staff of separate branches could be improved substantially.

- The computer support and publications staff appear to have been left out of the planning process for several big projects and publications recently.

IV. Major Recommendations of the Committee

General

The CSD is a valuable resource within academic, public and government arenas. The staff and their collaborators should take great pride in their accomplishments, vitality and promise for the future. With the promise, however, will come increasing pressures to do more with little or no increase in financial support. The administration and staff must work more aggressively towards improving this situation so that the promise can be realized.

The breadth of issues addressed by CSD programs and the depth of staff involvements in the Division's activities made the review period exciting, somewhat formal and tightly scheduled.

A. Division Administration

The Director has worked to sustain existing programs and promote the emerging areas of critical concern to Nebraska's future: soil and water resources. He should seek to draw senior scientists and principal investigator level staff into a well-planned process of reexamination of CSD's mission, goals and implementation in light of IANR's expectations. This process could be facilitated by judicious use of an outside facilitator (IANR has such individuals) to aid in communication between the disciplinary oriented branches. The process must be directed towards reaffirmation of CSD as a functional "Center."

Strategic Planning Recommendations

- As part of the mission and goal reexamination process it will be important to define research, survey and service activities more clearly.

The committee offers the following definitions as a starting point for the reexamination:

Research -- Experimental, theoretical, or field investigations designed to prove or disprove certain hypotheses or evaluate particular investigative methods. The research at CSD is generally more applied than it may be in academic units.

Survey -- Data collection activities centered on descriptions, mapping, correlations, etc. to better describe and evaluate the natural resources of the state.

Service -- The spectrum of information storage, handling, processing, retrieval and dissemination activities. These include non-research publications, map sales, public consultations, committee work, expert testimony, instruction, formal class teaching, workshops, presentations, etc.

Strategic Planning Recommendations

■ The strategic planning process within IANR should serve as a model for CSD's planning efforts with careful consideration of CSD's unique applied research, survey and service mission and its position of public contact between academic and state government structures.

■ CSD's reexamination of its future mission should evolve using the Self-Study Report and fresh staff input as a basis for the overall, prioritization of research, survey and service activities. Particular emphasis should be placed on Nebraska's most important resources: people, water and soil. All staff should be involved in the process once the universe of reasonable activities has been identified by senior staff.

■ From the above point, goals should be defined in the program areas which represent reasonable attainable goals under "no fiscal/staff support growth" and "incremental fiscal/staff support growth" scenarios. These should be formulated mindful of the eventual move of CSD and its remaining units to a combined facility.

■ When short- and long-term goals have been identified which are essential to the future viability of the CSD, strategies should be formulated to achieve the goals and fulfill the mission shared by IANR of national prominence in agriculture and natural resource institutions by the year 2000.

■ There is a strong indication from senior staff that functional or programmatic branches in the division may promote essential staff interaction and cooperation more effectively than the "disciplinary" branch system. The current system has the effect of isolating functionally similar individuals in different branches which may inhibit productivity. For example, the publication/map sales, publication planning and production, drafting and cartography (both manual and automated) really should be in the same functional group. These staff should also be involved in planning the final product delivery schedule (through the editor) so as to maintain steady work flow and output over the course of a year. (More specific recommendations are made in subsequent recommendations relative to the scientific branches).

■ It would be most beneficial to begin a series of staff research seminars. First, the senior staff and others should present the results and status of their major projects and research directions to better familiarize the entire staff (including out-state personnel) with the scientific direction of the division.

■ As the future management team is formed, it is important that training in personnel management be provided for branch chiefs and their designated assistants. A person should be identified as division personnel manager to act as a source of information on employee policies, rights, and counseling without the need for an individual to go to the director, branch chiefs or their assistants.

■ Personnel policies governing tenured and nontenured status should be reviewed and clarified:

a.) It is vital for the future of CSD and presumably other similar UNL units with public service (see definition, p. 15) components that the products of these efforts earn credit towards tenure rank.

b.) It is equally important to insure that 100% service staff are afforded nontenured (equivalent rank) status through a well-defined process. Although years of service should contribute to this status, suitable measures of productivity and performance should be made part of the annual evaluation process.

■ It would be expected that the future of the CSD research program would be planned with large-scale multidisciplinary research projects in mind. In this manner, the maximum profile for external research funding can be maintained. CSD's extensive joint research, survey and service activities will also benefit from this type of approach. There are numerous existing CSD activities which could be enriched in this manner.

■ Tenured staff must be strongly encouraged to provide direction and "mentoring" towards the development of the future leaders of the CSD. As a goal, tenured research staff should generate at least one proposal for extramural research funding per year if they are not at least 50% involved (i.e., as matching fund support) in an ongoing research effort.

■ More open disclosure of CSD budget totals for specific research, service and survey goals must be afforded to the senior staff. This will insure that perceived funding inequities or "favoritism" do not divide the staff or sap energies which must be channelled properly, particularly in the "no-growth" scenarios.

■ The broad nature of CSD's legislated mandate has been used as a poor substitute for program prioritization and planning, particularly in the geological area. Coordinated planning which more sharply defines the mission of CSD should bring out the best in all staff and reduce the mystique which seems to surround tenured-status within CSD.

■ Administrative attention must be given to maintain the survey (i.e., data collection, sample and data repository) efforts within the CSD. However important these traditional activities have been and will be in the future, the survival of CSD depends on increased support and intellectual growth. Research and service functions should be given particular attention to increase both external funding and public visibility.

■ It is important to encourage cooperative service and survey efforts both on and off campus. Whenever possible, existing extension facilities and personnel around the state should be shared with cooperating groups.

■ It is recommended that CSD report its project profiles and status to the Agricultural Research Division of IANR. This should encourage joint research projects and ensure that the maximum impact and value is derived from complementary efforts. Specific research direction should come from the individual scientists rather than from a central planning process.

Support Branch

■ The editor must be brought into branch chief level meeting and planning. In this way a thorough strategy to publicize, promote and advance the profile of CSD to various constituent groups can be implemented. It will also allow for more realistic effective publication schedules.

■ More CSD financial support should be allocated to the publications and other service activities.

■ The GIS and computer operations are more appropriately placed in the Support Branch. Priorities should be given to data repository mechanization and automated mapping techniques, taking advantage of CALMIT and related technologies. Data collection and other "survey" activities should be deemphasized until the current data have been placed in accessible digital form.

■ The computer service capabilities (i.e., microcomputers, mainframe computers and central word processing) must be upgraded within the next

two to three years. Much of the hardware is obsolete and there is a general growing trend towards more efficient and versatile PC-based text and graphics processing. The latter systems are quite versatile and would improve all support functions. There will be a learning curve associated with the modernization process but it is better approached in a planned fashion rather than to be "orphaned" by obsolescence.

■ It would be most favorable to renew the publication of the CSD cornerstone (i.e., peer-reviewed quality) publication series. Again, the improvement in the quality and distribution of research publications should have priority over continued data collection or drilling in the "survey" activity areas.

B. Geology Branch

■ It is desirable to sustain the major activities of this branch at a level sufficient for minimum service. Interdisciplinary projects in water and soil resources should be given <u>far more attention</u> than the oil, gas and mineral resource related activities.

■ The statutory requirements governing the geological survey activities at CSD should be carefully reviewed and reevaluated, particularly with respect to data collection and service activities.

■ It would be more effective to fold the "survey" related activities (i.e., data collection, data and sample repository) into a <u>service unit</u> within a mainly geologic and hydrogeologic branch providing on-demand services in water well-siting and design, geological consulting with the potential users of the mineral resources, etc. Placing all the geoscientists in this combined branch would encourage more active participation and interaction of tenured staff with nontenured staff, researchers, surveyors/mappers and service individuals. The details of this functional <u>and</u> disciplinary related branch should be a priority in the strategic planning process.

■ The "survey" service unit noted above should strive to generate some funds for maintenance of data and samples. User charges should be considered for labor-intensive service activities to help accelerate mechanization of data storage, processing and retrieval.

■ Geology Branch staff must become much more aggressive in attracting external funding for research.

■ Since this branch's activities embody Nebraska geology, the staff should work to promote geological research. The support of graduate

students via assistantships to undertake this research should be encouraged. This is one part of the "mentoring" which the senior tenured staff should extend to provide future leadership in this and other branches. This would also improve the output of peer-reviewed quality journal publications.

- The promotion of Nebraska geology research noted above should not be confined to Nebraska universities. Talented individuals should be sought from across the nation.

- The goals of the test-drilling, core-sample collection and mapping activities must be more detailed, realistic and modest given the needs in emerging research and service areas. Geophysical techniques should be applied to extending the existing stratigraphic record from the drilling programs.

- The core sample repository operation should be critically examined with an eye towards culling out duplicative samples and reducing the massive storage requirements. The cost of obtaining needed samples five to ten years in the future may be less than the interim lease, maintenance and storage costs for the many storage areas currently in use.

- State needs in the fields of engineering and environmental geology (e.g., water management, soil hazards and contamination problems) should be addressed through expanded cooperative programs with the UNL Geology Department.

C. Geographic Information Systems and Soil Branch

- This branch must be reorganized for more efficient operation and to consolidate closely related functions.

- The GIS activities should be placed in the Support Branch along with computer services.

- The group should also place a priority on aiding the modernization of data handling, etc.

- The CALMIT unit should be made a separate branch and focus on research and service functions.

- CALMIT should be allowed to grow in its current directions and be provided more visible facilities which are large enough to accommodate program activities in contiguous space.

■ The Soils unit should be made a separate branch with close ties to the "research" and service oriented part of the present Geology Branch.

■ Soil research activities should be particularly emphasized as the routine survey aspects of the accelerated soil survey wind down. Research goals should be quite specific and show relation to other IANR activities, particularly those in Agronomy.

■ Additional dollar support and soil scientists should be added for out-state services. These individuals may also aid in the effort to improve CSD visibility outside of Lincoln. Their major focus should be on service activities. An official involvement of CSD staff with soil scientists in the Experiment station would be a valuable step in this regard.

■ The relationship between the CSD and the federal SCS needs to be rescoped, renegotiated, and approved to reflect realistic mutual goals and contributions.

■ It is important that the Quaternary geology position be filled with consideration of the need for this expertise in geology, water and soil areas.

D. Water Branch

■ As stated previously, the water branch head must be selected or elected immediately. The geophysical staff and perhaps the hydrogeologists in the branch belong in the research and survey oriented part of a new Geology Branch. Nonetheless, there is a need for <u>branch</u> representation now in the CSD mission reexamination and strategic planning process.

■ Service and survey efforts in water quality will require maintenance of a laboratory facility with trained chemists to aid in data interpretation, database design and in producing reports. There is very little evidence of planning for laboratory facilities and support in the self-study document.

■ Lab facilities are critical to the future of <u>any</u> CSD "survey" or "service" related, chemical analysis activities (since the research laboratory capability will in large part be incorporated into the Water Center). They must be made part of the long range plan for CSD's future.

■ The impressive database on agricultural chemicals (i.e., NO_3^- and pesticides) which exists due to this group's efforts represents a great

■ The impressive database on agricultural chemicals (i.e., NO_3^- and pesticides) which exists due to this group's efforts represents a great advantage in planning future research, survey and service activities. It should be given top priority in the data mechanization process, particularly with respect to the ground-water quality atlas.

■ It is imperative that a competent hydrogeologist succeed the current well design/location contact (F. Smith) prior to his retirement. It would be expected that this position would also be in the new Geology Branch.

E. Cross-Cutting Issues

■ Without a doubt, the single largest challenge to CSD's future after improvement of facilities, the mission reexamination and strategic planning process is the retention of its future leaders.

■ Staff development and retention efforts are critical. The administration's lack of response to challenges from internal and external units may provide evidence of CSD's current difficulty with planning ahead. The staff has the energy and the vision to aid in the planning process if given the opportunity.

■ Water resource planning in the state is apparently at a very low level. It is clear that CSD needs to deemphasize traditional directions and pursue agriculturally-related resource issues (i.e., water and soils) with renewed enthusiasm. CSD should be a leader in water resource research and planning in the state.

■ Fragmented approaches to funding related to the Natural Resource Districts (NRD's) in the state (i.e., continued contracting with individual NRD's) must be deemphasized if a more comprehensive, continuing effort can be negotiated with the state NRD association.

January 7, 1969

MEMORANDUM

TO: Vice Chancellor Merk Hobson

FROM: Dean John R. Davis

In response to your December 18 appointment of an informal committee and your request that the committee review the objectives and work of the Conservation and Survey Division, the committee submits for your attention and transmittal to the Board of Regents the attached report. This committee met for three four-hour periods during December 30 to January 4 and deliberated our charge in detail. The counsel and assistance of Mr. Dreeszen and his staff are fully involved in our findings and were most helpful. Brief conversations between the chairman and Mr. Warren Fairchild and Dean Frank Trelease were also related to the committee.

The committee suggests that, if possible, I present this report to the Board to provide brief comments that may be of added value. We also suggest, at your discretion, that copies of the report be forwarded to the Liaison Committee and to the contemplated Academic Planning Committee when it is established. We also feel that the current legislative session and planning for the forthcoming biennium represent a degree of urgency and suggest that administrative reaction to the report as soon as possible would be desirable.

Our committee shall be pleased to discuss our recommendations with you at any time or to assist in the development of a strengthened University.

For the Committee--

Richard S. Harnsberger
Robert W. Kleis
Samuel B. Treves
John R. Davis

JRD:dl

Report of the Ad-Hoc Committee on

Conservation and Survey Division

> On December 18, Vice Chancellor Merk Hobson appointed an informal committe "to review the objectives of the Conservation and Survey Division--its present programs, its organization within the University, and its relationships with other units of the University--with the objective of making whatever recommendations the committee deems appropriate to the Chancellor and the Board of Regents."

A strong University has three generally inseparable responsibilities: teaching, research, and service. All academic parts of the University and some non-academic functions, such as library, computing center, museum, and Conservation and Survey Division, should fulfill each of these responsibilities as an integral and collaborative part of the University.

If a University is to respond appropriately to its responsibilities and to the challenges of the future, it must be willing to foster new organizational structures and different approaches--some of which may be broadly interdisciplinary whereas others may be problem oriented. The committee therefore felt unconstrained in its review of the functions of the Division, and its conclusions are based upon our desire to contribute to the development of a strong University that will meet its challenges.

The committee feels strongly that both the state and the University would benefit by a fresh approach toward education and research in the conservation and development of natural resources, with particular emphasis on basic framework, legal-economic-social, and long-term ecological research. For example, there should be developed soon some comprehensive studies on the future development of the Sandhills of Nebraska, on the potential for weather modification and hail suppression, and on broad questions of environmental pollution, in addition to framework studies of the state's resources. Obviously, such approaches will involve more interdisciplinary attention; and just as obvious, these approaches should not be dominated by today's project needs or undue political pressures. Furthermore, because the growth of the state and the region will involve possible conflicts in philosophy, there is a definite need for the state--through the University--to promote an unbiased scientific organization that can relate properly to the avoidance or the solution of such conflicts and other problems.

With this brief background, the following statements are pertinent:

1. The committee believes that the work of Conservation and Survey Division is essential to existing research and graduate programs at the University in most areas related to natural resources--geology, mineralogy, oil and gas,

soils, water and its occurrence, meteorology, economics, and law. We conclude that the basic framework studies and research of the Division have constituted a logical and viable part of the University's academic and extension programs--the uniqueness of the work of the Division as a unit of the University is in the nature of its more direct contributions to state and federal agencies. We therefore recommend that the Conservation and Survey Division be maintained within the University--much as the Museum, the Bureau of Business Research, and other programs--as a means of contributing to new basic knowledge and teaching efforts of the University.

The unique contribution of the Division to the development of the state has been a result of its role as a State Geological Survey, which is quite common relationship in many other states. To continue this relationship and the resulting service to the citizens of Nebraska would be most appropriate and necessary if there are to be made available data and research studies that are not project-oriented but that look ahead to the broader, more futuristic needs of the state. We strongly recommend that the Division's role as the State Geological Survey be continued and suggest that its current objectives are appropriate and worthy and consistent with the goals of the University.

2. The committee recommends that a Land and Water Resources Center be created as soon as possible, to foster the above concepts. The initial purposes of the Center are to stimulate creative and imaginative research and investigations relative to Nebraska's resources, to encourage faculty throughout the University to direct their attention to our current and future living environment, and to catalog and coordinate such research and related studies. The Center would also cooperate fully with agencies of state and federal government in serving their basic needs and interests.

3. The committee envisions an initial close involvement of the Conservation and Survey Division and the Water Resources Research Institute in the proposed Center, in order that framework data and results of other studies and research will be fully integrated with and be available for other research programs in the University. The two directors should still be responsible to the Vice-Chancellor for Academic Affairs; but because the Conservation and Survey Division and the Water Resources Research Institute have complimentary interests, we expect the two Directors to coordinate their programs to the maximum extent.

4. In order to assist in the development of programs of the Center, the committee recommends the appointment of a University Advisory Board to the Center. A purpose of

the Board would be to advise the Conservation and Survey Division, the Water Resources Research Institute, and other possible participants of the Center of appropriate broad areas of research and study, and to stimulate the coordination and strengthened efforts of all University functions relative to natural resources. The members of the Board should represent those colleges, department, and other units of the University that are engaged in education and research in natural resources and that can relate properly to the "big picture" in resource development and conservation, rather than to technical details. The directors of the Conservation and Survey Division and Water Resources Research Institute should serve initially as ex-officio members of this Board.

5. The committee recommends that the Advisory Board consider the desirability of increasing the efforts of the University and of the Division toward scientific studies that relate to broad programs or "great issues" in natural resources.

6. The committee suggests that the offering of graduate degrees in interdisciplinary areas of natural resources would be quite appropriate. Consistent with this, we would expect the Center to serve as a catalyst and a participant in such programs, in collaboration with the degree-granting departments.

In its review of the Conservation and Survey Division in relation to the purposes of the University, the committee made several observations that are pertinent to the future activities of the Division or the Center. We therefore make the following suggestions which we urge the Directors and the Advisory Board to consider and to implement.

1. The Conservation and Survey Division has developed many of its programs and activities in response to the long-range and immediate needs of other University groups and state and federal agencies. We believe this to be a most appropriate responsibility of the Division and suggest that this service be continued. Under no circumstances, however, should the Division become involved in any regulatory functions.

2. There is some merit to the development of a resources data bank in the state, as has been suggested elsewhere, provided that the data bank serves all interests of the state adequately and with optimum accessibility. The committee suggests that the University and the Division cooperate and contribute fully to the data bank and to other requests for framework and research data; because of the keen interests of the University in the availability of resource data, the University should partici-

pate actively in the development of guidelines for inputs and retrieval from such a data bank.

3. Consideration also should be given to drawing the Division even closer to the academic community by means of appointments in appropriate academic departments. Similarly, faculty in academic departments should be given temporary or permanent appointments and responsibilities in the Division. The reason for this recommendation is to enhance interdepartmental relations and consequently to foster the development of high quality teaching and research in the various fields of natural resources.

4. As some of the above concepts develop, we expect that the Division will continue to enlarge the academic qualifications of its staff. Qualified staff in the Division should be granted tenure and professorial appointments in the Division whenever appropriate.

   We understand the requirement for intimate knowledge of Nebraska's geology for the Division's geologists; for hydrologists, we suggest a continuation of efforts to avoid inbreeding and to achieve high academic quality in the staff. In this manner, the professional staff of the Division would hold academic qualifications equivalent to those of other University faculty who are engaged in research.

5. If the above recommendations and suggestions are accepted and adopted, the committee further suggests that the proposed directions of the Division and the Institute, as identified in part by the budget justification for the 1969-71 biennium, be reviewed in detail by the Advisory Board and the the Board submit its findings to the Directors and the Vice-Chancellor at the earliest possible date.

In general, the committee is pleased with the performance, the high morale, and conscientious attitude of the existing staff of the Division and commends them for their outstanding contributions to the state of knowledge on Nebraska's resources. We wish to emphasize again that there are some tremendous opportunities for the University to relate to the growing economy of the state, and we hope enthusiastically that the University can take advantage of the opportunity to develop a program with insight, depth, and quality. The Conservation and Survey Division and the proposed Center will certainly be important to the exploitation of these opportunities.

Richard S. Harnsberger
Robert W. Kleis
Samuel B. Treves
John R. Davis, Chairman

January 7, 1969

Statement for the Regents
on the
Conservation and Survey Division

The Board of Regents believes that the work of the Conservation and Survey Division is essential to existing research and graduate programs in most areas related to natural resources. The basic studies and research of the Division constitute a logical and viable part of the University's academic and extension programs.

Therefore, the Board recommends that the Conservation and Survey Division be maintained as an integral part of the University, as a means of contributing new basic knowledge and teaching in land and water resources.

The Board believes that the offering of graduate degrees in interdisciplinary areas of natural resources is a worthy objective of the University. The Division and the Water Resources Research Institute together could serve as catalysts and participants in such programs, in collaboration with degree-granting departments.

Further, the Board does believe that consideration should be given to drawing the Division closer to the academic community by means of joint appointments with appropriate departments. It is expected that the Division will continue to enlarge the academic qualifications of its staff and that increased efforts will be made by the Division to relate to broader research programs or "great issues" in Nebraska's natural resources.

The Board suggests that the University and the Division contribute fully to a proposed statewide data bank and participate actively in the development of guidelines for inputs and retrieval from such a data bank. However, under no circumstances should the Division become involved in any regulatory functions normally ascribed to state government.

To provide for and to promote an unbiased scientific organization that can relate properly to both short- and long-range needs for education and research in natural resources, the Board of Regents recommends that the services and research of the Division be continued as a University responsiblility to the state and that the programs of the Division be enhanced in scope and in quality.

February, 1969

APPENDIX 3

CSD
FACULTY PROFILES

NAME: **JERRY F. AYERS**

TITLE AND RANK: Hydrogeologist, Associate Professor
(.25 FTE appointment in Dept. of Geology)

TERMINAL DEGREE: Ph.D., 1980, Washington State University (Hydrogeology)

TENURE DATE: 1993

GRADUATE FACULTY: Fellow

YEARS AT CSD: 10

COURTESY APPOINTMENTS:

RESEARCH/SERVICE INTERESTS:

(1) Application of geophysics to hydrogeologic investigations and development of techniques.

(2) Development of in-situ methods for characterizing aquifer properties.

(3) Sampling environments around high-capacity wells.

(4) Regional groundwater flow and evaluation of groundwater chemistry.

(5) Geophysical surveys of archaeological sites.

CURRENT PROJECT ACTIVITY:

Research:

Hydraulics of high-capacity wells.
Regional groundwater flow and geochemistry of Alkali Lakes, western Sandhills.
Hydrogeology of saline wetlands.

Scholarly Service:

Reviewing low-level radioactive waste site application.
Reviewing natural resources district Groundwater Management Plans.
Reviewing USGS Section 105 proposals and journal manuscripts.

Teaching:

Two courses taught in Geology -- Exploration Geophysics I and II

NAME: **RAYMOND R. BURCHETT**

TITLE AND RANK: Research Geologist, Professor

TERMINAL DEGREE: M.S., 1959, University of Nebraska (Geology)

TENURE DATE: 1980

GRADUATE FACULTY: Fellow

YEARS AT CSD: 36

COURTESY APPOINTMENTS: Department of Geology

RESEARCH/SERVICE INTERESTS:

(1) Geologic and mineral resources research.

(2) Service on mineral resources in Nebraska.

(3) Service on earthquakes in Nebraska.

CURRENT PROJECT ACTIVITY:

Research:

Geologic studies of individual Nebraska counties.

Scholarly Service:

Answering questions about the geology and mineral resources of Nebraska.

NAME: **MARVIN P. CARLSON**

TITLE AND RANK: Research Geologist, Professor

TERMINAL DEGREE: Ph.D., 1969, University of Nebraska (Geology)

TENURE DATE: 1977

GRADUATE FACULTY: Fellow

YEARS AT CSD: 37

COURTESY APPOINTMENTS: Department of Geology

RESEARCH/SERVICE INTERESTS:

(1) Paleozoic lithostratigraphy, Precambrian tectonics and mineral resources of the northern midcontinent.

(2) Aspects of earth science for teachers, elementary to college classes, and the general public.

(3) Resource development, environmental impacts, waste disposal, stress on natural resources systems and public perceptions of earth science.

CURRENT PROJECT ACTIVITY:

Research:

Deep well stratigraphic investigations.
Precambrian of Nebraska.
Stratigraphic succession in Nebraska.

Scholarly Service:

Review manager for technical review of application for low-level radioactive waste facility.
Numerous professional society committees.

Teaching:

Workshops for earth science teachers.

NAME: **XUN-HONG CHEN**

TITLE AND RANK: Research Hydrogeologist, Ass't Professor

TERMINAL DEGREE: Ph.D., 1994, University of Wyoming (Hydrogeology)

TENURE DATE: 2001

GRADUATE FACULTY: Member

YEARS AT CSD: 1

COURTESY APPOINTMENTS:

RESEARCH/SERVICE INTERESTS:

(1) Groundwater flow and contaminant transport modeling in the saturated zone and vapor flow modeling in the vadose zone.

(2) Using numerical models in the design and analyses of a remediation system.

(3) Stochastic study of aquifer heterogeneity.

(4) Water quality data analysis using statistical and geostatistical techniques.

CURRENT PROJECT ACTIVITY:

Research:

Developing analytical and numerical techniques for the analysis of air/vapor flow in the vadose zone.
Modeling biodegradation and volatilization of organic contaminants along an air-sparging trench.
Assessing spatial and temporal variations of domestic well groundwater quality in rural Nebraska.
Well hydraulic studies.

Scholarly Service:

Modeling TNT concentration variation in a laboratory remediation study (Department of Agronomy).

NAME: **HAROLD M. DEGRAW**

TITLE AND RANK: Research Geologist, Ass't Professor

TERMINAL DEGREE: M.S., 1969, University of Nebraska (Geology)

TENURE DATE: 1980

GRADUATE FACULTY:

YEARS AT CSD: 36

COURTESY APPOINTMENTS: Department of Geology

RESEARCH/SERVICE INTERESTS:

(1) Cenozoic and Mesozoic stratigraphy.

(2) Tertiary and Cretaceous stratigraphy.

CURRENT PROJECT ACTIVITY:

Research:

Western Interior Cretaceous (WIK) project.
Niobrara stratigraphy of western Nebraska.
Evaluation of oil, gas and uranium resources of Nebraska.

Scholarly Service:

Provide technical assistance on numerous requests about Tertiary and Cretaceous strata related to oil and gas exploration, basic well data, groundwater sources and geothermal prospects.

NAME: **ROBERT F. DIFFENDAL, JR.**

TITLE AND RANK: Research Geologist, Professor

TERMINAL DEGREE: Ph.D., 1971, University of Nebraska (Geology)

TENURE DATE: 1986

GRADUATE FACULTY: Fellow

YEARS AT CSD: 15

COURTESY APPOINTMENTS: Department of Geology, State Museum

RESEARCH/SERVICE INTERESTS:

(1) Stratigraphy.

(2) Sedimentology.

(3) Geomorphology.

(4) Invertebrate Paleontology.

(5) Outreach-school children, University students, citizens.

CURRENT PROJECT ACTIVITY:

Research:

Geologic mapping - western and north central Nebraska.
Stratigraphic studies.
Geomorphic development of Yellow Mountain, P.R. China

Scholarly Service:

Talks to school children, service organizations, etc.

NAME: **DUANE A. EVERSOLL**

TITLE AND RANK: Associate Director, Geologist, Associate Professor

TERMINAL DEGREE: M.S., 1977, University of Nebraska (Geology)

TENURE DATE: 1981

GRADUATE FACULTY:

YEARS AT CSD: 18

COURTESY APPOINTMENTS:

RESEARCH/SERVICE INTERESTS:

(1) Landslide/ground failure inventory of Nebraska.

(2) Mineral resources inventory and geothermal research.

(3) Geological engineering.

(4) Geology of McCook 2 degree Quadrangle (mineral resources, groundwater, etc.)

CURRENT PROJECT ACTIVITY:

Research:

Landslides in Nebraska.
Groundwater and subsurface geology in SW Nebraska (McCook 2 degree quad).

Scholarly Service:

Judge for Burwell Award, best publication in Engineering Geology Division of Geological Society of America.
Geological technical assistance to Nebraska Department of Health on water well design, drilling, construction and location.
Geological engineering assistance to Nebraska Department of Roads on landslides, ground failures and water wells in Nebraska.
Geological assistance on groundwater availability in SW Nebraska to citizens, cities and water well drillers.

NAME: **JAMES W. GOEKE**
(stationed at North Platte)

TITLE AND RANK: Hydrogeologist, Associate Professor

TERMINAL DEGREE: M.S., 1970, Colorado State (Groundwater Geology)

TENURE DATE: 1980

GRADUATE FACULTY:

YEARS AT CSD: 25

COURTESY APPOINTMENTS:

RESEARCH/SERVICE INTERESTS:

(1) Regional groundwater studies.

(2) Assistance with groundwater quality and quantity management.

(3) Groundwater and geologic educational programs.

(4) Acid rain monitoring.

(5) Stream-aquifer relationships in Nebraska.

CURRENT PROJECT ACTIVITY:

Research:

South Central Sandhills groundwater model.
Sandhills chronology.
Groundwater quality at the Gudmundsen Sandhills Research Lab.
Sandhills meadow hydrology at Gudmundsen Sandhills Research Lab.

Scholarly Service:

Groundwater and geology presentations at conferences, agribusiness groups, natural resources districts, Children's Groundwater Festival, UNL, statewide high school class lectures, and legislative committees.

NAME: **DAVID C. GOSSELIN**

TITLE AND RANK: Hydrogeologist/Geochemist, Associate Professor

TERMINAL DEGREE: Ph.D., 1987, South Dakota School of Mines (Geology)

TENURE DATE: 1995

GRADUATE FACULTY: Fellow

YEARS AT CSD: 6

COURTESY APPOINTMENTS: Department of Geology

RESEARCH/SERVICE INTERESTS:

(1) Evolution of lakes/wetlands, western Sandhills and relationship to climate change.
(2) Nonpoint-source contamination: integrated evaluation using hydrogeology and chemistry.
(3) Remote sensing and applications to hydrology.
(4) Application of geochemistry to understanding hydrologic system dynamics.
(5) Improving earth science education at local and national levels.

CURRENT PROJECT ACTIVITY:

Research:

Monitoring lakes and wetlands for detecting environmental/climatic change.
Alkali Lakes Project.
Evaluation of irrigation wells as sampling mechanisms.
Hydrologic dynamics of wet meadows in the Nebraska Sandhills.
Domestic well groundwater quality in rural Nebraska: assessing spatial and temporal variations.

Scholarly Service:

Project Manager for Nebraska Earth Science Education Network (NESEN).
Coordinate and teach NESEN summer workshops.
Provide workshops at the Nebraska Association of Teachers of Science (NATS) annual meeting on various topics.
Technical reviewer of licensing application for low-level radioactive waste site.
Liaison to USGS Central Nebraska National Water Quality Assessment (NAWQA) Program.

NAME: **F. EDWIN HARVEY**

TITLE AND RANK: Geologist, Assistant Professor

TERMINAL DEGREE: Ph.D. 1995, University of Waterloo (Canada) (Hydrogeology)

TENURE DATE: 2002

GRADUATE FACULTY:

YEARS AT CSD: Hired 9/1/95

COURTESY APPOINTMENTS:

RESEARCH/SERVICE INTERESTS:

(1) Hydrogeology of glacial deposits of eastern Nebraska.

(2) Groundwater/surface water interactions in lakes and reservoirs.

(3) Use of isotopes and tracers in groundwater studies.

CURRENT PROJECT ACTIVITY:

Research:

Scholarly Service:

NAME: **MARK S. KUZILA**

TITLE AND RANK: Head Soil Scientist, Associate Professor

TERMINAL DEGREE: Ph.D., 1988, Univ. of Nebraska-Lincoln (Agronomy)

TENURE DATE: 1995

GRADUATE FACULTY: Member

YEARS AT CSD: 20

COURTESY APPOINTMENTS: Department of Agronomy

RESEARCH/SERVICE INTERESTS:

(1) Soils and landscapes.

(2) Pesticide mobility in soils.

(3) Wetlands.

CURRENT PROJECT ACTIVITY:

Research:

Changes in soil interpretations because of soil survey updates.
Soil morphology and age of parent material.
Pesticide mobility in terraced soils.

Scholarly Service:

Coordinator for Nebraska cooperative soil surveys.
Soil survey evaluation for property tax equalization.
Historical aerial photo analysis and interpretation.

NAME: **SUSAN OLAFSEN LACKEY**
(Stationed at Norfolk, NE)

TITLE AND RANK: Assistant Geoscientist (faculty equivalent rank)

TERMINAL DEGREE: B.S., 1982, South Dakota School of Mines

TENURE DATE: N/A

GRADUATE FACULTY:

YEARS AT CSD: 4

COURTESY APPOINTMENTS:

RESEARCH/SERVICE INTERESTS:

(1) Hydrologic systems and interaction of groundwater and surface water.

(2) Public information and education in earth sciences.

(3) Groundwater quantity and quality in northeast Nebraska.

(4) Environmental geology.

CURRENT PROJECT ACTIVITY:

Research:

Groundwater characterization and monitoring.
Nitrate concentrations related to nonpoint source contamination.

Scholarly Service:

Technical review of natural resources districts' groundwater management plans and monitoring programs.
Technical consultant to area natural resources districts.
Groundwater festival presentations and public information on natural resources.
Respond to specific data requests from individuals, industry, governmental agencies and others.

NAME: **JAMES W. MERCHANT**

TITLE AND RANK: Assoc. Director CALMIT, Associate Professor

TERMINAL DEGREE: Ph.D., 1984, University of Kansas (Geography)

TENURE DATE: 1995

GRADUATE FACULTY: Fellow

YEARS AT CSD: 6

COURTESY APPOINTMENTS: Departments of Geography; Ag. Meteorology; Agronomy; and Forestry, Fisheries & Wildlife

RESEARCH/SERVICE INTERESTS:

(1) Global and regional land cover mapping via satellite remote sensing.

(2) Characterization and exploitation of vertical and horizontal landscape structure via remote sensing.

(3) Integration of remote sensing and geographic information systems for environmental assessment and modelling.

CURRENT PROJECT ACTIVITY:

Research:
Four active funded grants focusing on landscape regionalization and large-area land-cover characterization, GAP analysis (biodiversity) of Nebraska, and GIS data for public agencies.

Scholarly Service:
Associate editor of *Photogrammetric Engineering and Remote Sensing.*
Secretary of MidAmerica GIS Consortium.
Organizer and chair of Nebraska Geographic Information Systems Forum.
Member of Technical Subcommittee, Nebraska GIS Steering Committee.
Planning committees for four regional/national conferences.

Teaching:
Approximately one course per semester through Department of Geography. Courses include Geographic Information Systems, Remote Sensing I, Seminar in Remote Sensing/GIS. Also advise 5 graduate students and serve on 12 graduate committees.

NAME: **ROGER K. PABIAN**

TITLE AND RANK: Research Geologist, Professor

TERMINAL DEGREE: M.S., 1970, UNL (Geology)

TENURE DATE: 1980

GRADUATE FACULTY: Fellow

YEARS AT CSD: 28

COURTESY APPOINTMENTS: Adjunct Curator, Invertebrate Paleontology, University of Nebraska State Museum, and Department of Geology

RESEARCH/SERVICE INTERESTS:

(1) Late Paleozoic echinoderms, trilobites, invertebrate paleontology.

(2) Late Paleozoic paleoecology, biostratigraphy.

(3) Preparation of educational materials for general public.

CURRENT PROJECT ACTIVITY:

Research:

Late Paleozoic crinoids, conodonts from mid-continent North America.
Development of educational materials.
Late Paleozoic biostratigraphy and paleoecology.

Scholarly Service:

Development of Museum galleries in paleontology and paleobiology.
Placing old Nebraska Geological Survey invertebrate fossil collections into a standardized catalogue and establishing a database for it.
Presentations on Nebraska geology, paleontology and mineralogy to schools and service clubs, and educational units such as nature centers.

Teaching:

Teach course on gemstones and present occasional lectures on invertebrate paleontology in Department of Geology.

NAME: **DARRYLL T. PEDERSON**

TITLE AND RANK: Research Hydrogeologist, Professor
(.50 FTE appointment in Geology)

TERMINAL DEGREE: Ph.D., 1971, Univ. Of North Dakota (Geology)

TENURE DATE: 1979

GRADUATE FACULTY: Fellow

YEARS AT CSD: 20

COURTESY APPOINTMENTS:

RESEARCH/SERVICE INTERESTS:

(1) Surface water/groundwater interaction, quantity and quality.

(2) Response of aquifers to development.

(3) Characterization of aquifer heterogeneity.

CURRENT PROJECT ACTIVITY:

Research:

Contaminant movement with induced recharge from the Platte River into the Lincoln well field.
Groundwater movement into the Dismal River.
Effect of wetlands on water quality.

Scholarly Service:

Application review for low-level radioactive waste site.
Review committee for Well Head Protection Program.
Assistance to consultants working on water projects.

Teaching:

Groundwater Geology 488/888 (Department of Geology)
Hydrogeology 889 (Department of Geology)
Supervising 7 masters and 3 doctoral programs.

NAME: **DONALD C. RUNDQUIST**

TITLE AND RANK: CALMIT Director and Professor

TERMINAL DEGREE: Ph.D., 1977, UNL (Geography)

TENURE DATE: 1982

GRADUATE FACULTY: Fellow

YEARS AT CSD: 13

COURTESY APPOINTMENTS: Departments of Geography, Ag. Meteorology, Agronomy

RESEARCH/SERVICE INTERESTS:

(1) Hyperspectral remote sensing of lake and wetland systems.
(2) Remote sensing of rangeland environments (especially Nebraska Sandhills)
(3) Field techniques in remote sensing.
(4) Agricultural applications of GIS

CURRENT PROJECT ACTIVITY:

Research:

Close-range remote sensing of surface water.
Close-range remote sensing of wetland macrophytes.
Remote sensing of Western Lakes region of Sandhills to establish linkages with environmental variability/change.
Use of ERS-1 synthetic-aperture radar data for analyzing Sandhills wetlands.

Scholarly Service:

Field-spectral measurements of rangeland test plots at Gudmundsen Sandhills Lab.
Various workshops/training courses developed to transfer remote-sensing technologies to public schools.
Consortium for the Application of Space Data to Education (CASDE)/KidSat Project.

Teaching:

Geography/Geology/Agronomy 419/819 -- Remote Sensing I (every fall semester)
Geography/Geology 498/898 -- Remote Sensing for Water Resources Assessment (every spring semester)
Chair of six Ph.D. committees, one M.A. committee, and a member of 15 other graduate committees in various departments.

NAME: **STEVEN S. SIBRAY**
(Stationed at Scottsbluff, NE)

TITLE AND RANK: Assistant Geoscientist (faculty equivalent rank)

TERMINAL DEGREE: M.S., 1977, Univ. Of New Mexico (Geology)

TENURE DATE:

GRADUATE FACULTY:

YEARS AT CSD: 6

COURTESY APPOINTMENTS:

RESEARCH/SERVICE INTERESTS:

(1) Modeling groundwater flow.

(2) Geochemistry of groundwater.

(3) Economic geology -- uranium and petroleum exploration and production.

CURRENT PROJECT ACTIVITY:

Research:

Modeling hydraulic behavior of the Brule Formation.
Groundwater quality of the North Platte NRD area.
Alkali lakes research team member.

Scholarly Service:

Reports on water-level changes in the Nebraska Panhandle.
Groundwater quality in Deuel County.
Groundwater and geology presentations at conferences, agribusiness groups, natural resources districts, etc.

NAME: **VERNON L. SOUDERS**

TITLE AND RANK: Hydrogeologist, Associate Professor

TERMINAL DEGREE: B. S., 1958, Univ. Of Nebraska (Geology)

TENURE DATE: 1980

GRADUATE FACULTY:

YEARS AT CSD: 33

COURTESY APPOINTMENTS:

RESEARCH/SERVICE INTERESTS:

(1) Stratigraphy.

(2) Paleotopography and former base levels of main-stem streams.

(3) Cenozoic structural movements.

(4) Delineation of aquifers; sources of sand, gravel, silt and volcanic ash.

CURRENT PROJECT ACTIVITY:

Research:

Geologic mapping of Broken Bow, NE 1 x 2 degree topographic sheet. Includes mapping bedrock outcrops, defining stratigraphy, constructing geologic sections and mapping three paleotopographic surfaces in an area of about 8000 square miles.

Scholarly Service:

Answer questions on Nebraska's water supplies.

NAME: **MARY EXNER SPALDING**

TITLE AND RANK: Hydrochemist, Professor

TERMINAL DEGREE: M.S., 1972, Texas A&M Univ. (Geochemistry)

TENURE DATE: 1992

GRADUATE FACULTY: Member

YEARS AT CSD: 21

COURTESY APPOINTMENTS:

RESEARCH/SERVICE INTERESTS:

(1) Agrichemical (nitrate and pesticide) contamination of groundwater.

(2) Sprinkler irrigation as a remediation alternative for volatile organic chemicals.

(3) Utilization of stable isotopes of N in ground and surface water investigations.

CURRENT PROJECT ACTIVITY:

Research:

Sprinkler irrigation as a remedial technique for VOC-contaminated ground water.

Scholarly Service:

NAME: **SCOTT E. SUMMERSIDE**

TITLE AND RANK: Assistant Geoscientist (faculty equivalent rank)

TERMINAL DEGREE: M.S., 1991, Univ. of Arizona (Water Resources Admin.)

TENURE DATE:

GRADUATE FACULTY:

YEARS AT CSD: 1

COURTESY APPOINTMENTS:

RESEARCH/SERVICE INTERESTS:

(1) Service to the public on issues related to groundwater quantity, quality and impacts of groundwater use.

(2) Hydrogeologic database design and development; hydrogeologic mapping.

(3) Hydrostratigraphy and chemical quality of the Dakota Group of southeastern Nebraska.

(4) Hydrostratigraphy of unconsolidated Quaternary deposits of southeastern Nebraska.

CURRENT PROJECT ACTIVITY:

Research:

Hydrogeologic database for Douglas County.

Comparison of computer assisted and non-automated techniques for mapping depth to water, a limiting factor used in regulating the application of herbicides.

Representative cross-sections of Nebraska's 13 groundwater regions (Department of Health study on domestic well water quality).

Participation in test-hole drilling and well installation activities for various hydrogeologic projects.

Scholarly Service:

Technical review of hydrogeologic aspects of Groundwater Management Plans for Lower Platte South and Lower Platte North Natural Resources Districts.

Technical review of groundwater reports for proposed housing developments in the Lincoln area.

NAME: **JAMES B. SWINEHART**

TITLE AND RANK: Research Geologist, Associate Professor

TERMINAL DEGREE: M.S., 1979, UNL (Geology)

TENURE DATE: 1980

GRADUATE FACULTY: Member

YEARS AT CSD: 25

COURTESY APPOINTMENTS: Department of Geology

RESEARCH/SERVICE INTERESTS:

(1) Cenozoic stratigraphy, sedimentology and sedimentary petrography of the Great Plains.

(2) Eolian sedimentology/chronology of Nebraska Sandhills with emphasis on climate changes of the last 20,000 years.

(3) Tephrochronology.

CURRENT PROJECT ACTIVITY:

Research:

Chronology and depositional history of the Nebraska Sandhills (Neogene).
Geologic maps of Alliance and Valentine 1:250,000 quadrangles.
Dakota stratigraphy and tidal rhythmites in Southeast Nebraska.

Scholarly Service:

145 personal contacts during 1994 on Sandhills geologic history; petrographic techniques; Cenozoic stratigraphic and lithologic information; Neogene, fluvial and glacial deposits of Nebraska; and vibracoring techniques.

Teaching:

Geology 496/896 -- 10-day field trip to Mexico (1credit)

NAME: **PERRY B. WIGLEY**

TITLE AND RANK: Director and Professor

TERMINAL DEGREE: Ph.D.. 1968, Virginia Polytechnic Inst. (Geology)

TENURE DATE: 1987

GRADUATE FACULTY:

YEARS AT CSD: 8

COURTESY APPOINTMENTS:

RESEARCH/SERVICE INTERESTS:

(1) Urban geology.

(2) Water levels in Nebraska.

(3) Availability of aggregate materials in Nebraska.

CURRENT PROJECT ACTIVITY:

Research:

Geology of the Omaha-Kansas City corridor.
Water levels in Nebraska.

Scholarly Service:

NAME: **LIMIN YANG**
(stationed at EROS Data Center, Sioux Falls, SD)

TITLE AND RANK: Assistant Geoscientist (faculty equivalent rank)

TERMINAL DEGREE: Ph.D. 1994, UNL (Geography)

TENURE DATE:

GRADUATE FACULTY:

YEARS AT CSD: 2

COURTESY APPOINTMENTS:

RESEARCH/SERVICE INTERESTS:

(1) Physical climatology, satellite bioclimatology, agricultural climatology, climate change and monitoring.

(2) Application of remote sensing and geographic information systems (GIS) technology to global and regional environmental studies and land surface physical processes.

CURRENT PROJECT ACTIVITY:

Research:

Global 1 km land cover characterization database development using NOAA satellite data.
Study of large area vegetation dynamics from satellite and climate data.

Scholarly Service:

Visiting scientist at USGS EROS Data Center

Senior Scientist, Commission of Integrated Survey and Natural Resources, the Chinese Academy of Science and the State Planning Commission.

APPENDIX 4

CSD AND FACULTY PUBLICATIONS

CONSERVATION & SURVEY DIVISION

PUBLICATIONS

1990-1995

1990

Water Survey Papers

WSP-67 Groundwater Levels in Nebraska, 1989 - $6.50

Test-Hole Reports

THR-19 Colfax County - $3.00

THR-27 Dodge County - $4.75

THR-34 Gage County - $4.75

THR-44 Hitchcock County - $4.75

THR-48 Jefferson County - $4.50

THR-55 Lancaster County - $7.00

THR-74 Richardson County- $9.50

THR-78 Saunders County - $5.00

THR-85 Thayer County - $3.00

Soil Surveys

SS-276 Sherman County Soil Survey - $3.50

SS-177 Loup County Soil Survey - $3.50

Water Survey Maps

GM-12 Test Hole Location Map, revised, 1:500,000 - $3.50

Soil Maps

SM-4 General Soil Map of Nebraska, M.S. Kuzila, compiler, 1:100,000 - $3.00

Land Use Maps

LUM-28 Center Pivot Irrigation Systems in Nebraska, 1988, D.C. Rundquist, color print, 1:1,000,000 - $2.50

Resource Atlases

RA-5a An Atlas of the Sand Hills, A.S. Bleed and C.A. Flowerday, eds., paper-bound - $15.00

Educational Circulars

EC-4a Earthquakes in Nebraska, R.R. Burchett - $4.50

Miscellaneous Publications

MP-30 Nebraska Mineral Operations Review, 1989, R.R. Burchett and D.A. Eversoll - $1.00

General Information Maps and Charts ($.50 each)

GIM-15 Aeromagnetic Map of Nebraska, R.R. Burchett, 3 pp.

GIM-17 Bentonite Deposits in Nebraska, R.R. Burchett, 3 pp.

GIM-18 Bouguer Gravity Anomaly Map, R.R. Burchett, 3 pp.

GIM-19 Clay and Shale Deposits in Nebraska, R.R. Burchett, 5pp.

GIM-20 Coal Deposits in Nebraska, R.R. Burchett, 3 pp.

GIM-22 Diatomaceous Earth Deposits in Nebraska, R.R. Burchett, 3 pp.

GIM-23 Earthquakes in Nebraska, R.R. Burchett, 2 pp.

GIM-26 Flint Deposits in Nebraska, R.R. Burchett, 2 pp.

GIM-28 Gypsum Deposits in Nebraska, R.R. Burchett, 3 pp.

GIM-29 Limestone Deposits in Nebraska, R.R. Burchett, 4 pp.

GIM-34 Peat Deposits in Nebraska, R.R. Burchett, 3 pp.

GIM-36 Potash Deposits in Nebraska, R.R. Burchett, 3 pp.

GIM-37 Quartzite Deposits in Nebraska, R.R. Burchett, 3 pp.

GIM-39 Salt Deposits in Nebraska, R.R. Burchett, 3 pp.

GIM-40 Sand and Gravel Deposits in Nebraska, R.R. Burchett, 3 pp.

GIM-41 Sandstone Deposits in Nebraska, R.R. Burchett, 4 pp.

GIM-42 Topographic Maps, 1 x degree x 2 degree Series, R.R. Burchett, 2 pp.

GIM-43 Topographic Maps, 7.5-minute Series, R.R. Burchett, 2 pp.

GIM-44 Uranium Deposits in Nebraska, R.R. Burchett, 3 pp.

GIM-45 Volcanic Ash Deposits in Nebraska, R.R. Burchett, 4 pp.

Open-File Reports

Hydrogeology of the Lower Platte Valley Alluvial Aquifer, Part 2: Groundwater Flow Model Update, J.F. Ayers, 242 pp.

Other

Resource Notes, 1989-90 Annual Report of the Conservation and Survey Division, Vol. IV, 40 pp., - Free.

1991

Water Survey Papers

WSP-68 Bazile Triangle Groundwater Quality Study, D.C. Gosselin - $4.50

WSP-71 Groundwater Levels in Nebraska, 1991 - $10.00

Test-Hole Reports

THR-11 Burt - $3.50

THR-22 Dakota - $2.50

THR-63 Nancy - $4.50

THR-87 Thurston - $3.75

Soil Surveys

SS-175 Saline County Soil Survey - $3.50

Geologic Maps and Charts

GMC-2 Bedrock of Nebraska with Geologic Time and Rock Chart, revised, R.R. Burchett and R.K. Pabian, 11" x 17" color print - $.50

GMC-26 Geologic Map Showing Configuration of the Bedrock Surface, North Platte 1 x 2 Degree Quadrangle, Nebraska, (USGS Map I-2277), R.F. Diffendal, Jr. (1:250,000) - $5.50

Land-Use Maps

LUM-31 Groundwater Vulnerability to Contamination in Nebraska Using the DRASTIC Method: Color Print (1:1,000,000) - $2.50

Educational Circulars

EC-9 Late Paleozoic Cyclic Sedimentation in Southeastern Nebraska: A Field Guide, R.K. Pabian and R.F. Diffendal, Jr., - $5.50

Miscellaneous Publications

MP-31 Nebraska Mineral Operations Review, 1990, R.R. Burchett and D.A. Eversoll - $1.00

General Information Maps and Charts

GIM-16 Barite Deposits in Nebraska, R.R. Burchett, 3 pp.

GIM-21 Crow Butte Uranium Deposit, R.R. Burchett, 2 pp.

GIM-23 Earthquakes in Nebraska, R.R. Burchett, 2 pp.

GIM-24 Explanation of Water-Level Hydrographs, P.B. Wigley, M.J. Ellis and G.V. Steele, 2 pp.

GIM-31 Cement Operations in Nebraska, R.R. Burchett, 3 pp.

GIM-32 Ocher Deposits in Nebraska, R.R. Burchett, 2 pp.

GIM-46 Radon Deposits in Nebraska, R.R. Burchett, 3 pp.

GIM-48 Geologic Bedrock Map of Nebraska, R.R. Burchett and R.K. Pabian, 2 pp.

GIM-49 Composite Section of Outcropping Rocks Along the Missouri River, R.R. Burchett, 1 pp.

GIM-50 Master of Science Theses and Doctor of Philosophy Dissertations, Department of Geology, University of Nebraska-Lincoln, R.R. Burchett, 10 pp.

Open-File Reports

Well-Head Protection Areas -- Lincoln Well Field, Ashland, Nebraska, J.F. Ayers, 33 pp. and 1 over-sized map.

The Rivers of Nebraska -- Character, Conflicts and Cooperation: Report for the 1991 Nebraska Water Conference, R. Bentall - $6.00

Other

Resource Notes, 1990-91 Annual Report of the Conservation and Survey Division, Vol. V, 33 pp. - Free

1992

Water Survey Papers

WSP-69 Groundwater Levels in Nebraska, 1990, G.V. Steele (USGS), P.B. Wigley (CSD), - $8.00

WSP-70 Hydrogeology of Parts of the Twin Platte and Middle Republican Natural Resources Districts, Southwestern Nebraska, J.W. Goeke, J.M. Peckenpaugh, R.E. Cady, J.T. Dugan - $13.50

WSP-71 Groundwater Levels in Nebraska, 1991, G.V. Steele (USGS), P.B. Wigley (CSD), - $10.00

Test-Hole Reports

THR-6 Boone County - $5.50

THR-26 Dixon County - $4.50

THR-39 Greeley County - $5.25

THR-92 Wheeler County - $4.50

Soil Surveys

SS-178 Brown County - $2.50

Miscellaneous Publications

MP-32 Nebraska Mineral Operations Review, 1991, R.R. Burchett and D.A. Eversoll - $1.00

MP-34 Socio-Economic Assessment Study of the Cedar River Basin, Nebraska, R.D. Kuzelka and N.B. Mutunayagam - $6.00

General Information Maps and Charts

GIM-30 Mineral Resource Map of Nebraska, 1 p., R.R. Burchett - $0.50

GIM-33 Oil and Gas Fields in Nebraska, 1 p., R.R. Burchett - $0.50

GIM-38 Mineral Facts for Nebraska, 15 pp., R.R. Burchett - $0.50

GIM-47 Oil and Gas Facts for Nebraska, 8 pp., R.R. Burchett - $0.50

GIM-51 Description of Rocks from a Core Drilled at a Potential Low-Level Radioactive Waste Site in Nemaha County, 3 pp., R.R. Burchett - $0.50

Other

CSD Expertise Directories - 2 versions (technical and non-technical), - Free

Resource Notes, 1991-1992, annual report of the Conservation and Survey Division, Vol VI, 28 p. - Free

Resource News, 1992, Bi-monthly newsletter of the Conservation and Survey Division, 4 issues, 4 p. each - Free

1993

Test-Hole Reports

THR-14 Cedar County - $7.00

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THR-70 Pierce County - $5.00

Soil Surveys

SS-179 Greeley County - $3.50

SS-180 Blaine County - $3.50

Resource Reports

RR-12 Flat Water: A History of Nebraska and Its Water, R.D. Kuzelka, project manager, and C.F. Flowerday, editor 240 pp - $20.00

Educational Circulars

EC-10 Geology, Geologic Time and Nebraska, M.P. Carlson, 40 pp. - $5.50

Professional Papers

PP-1 Taxonomy, Paleoecology and Biostratigraphy of the Crinoids of the South Bend Limestone (Late Pennsylvanian-Missourian, ? Virgilian) in Southeastern Nebraska and Southeastern Kansas, R.K. Pabian and H.L. Strimple - $6.50

Miscellaneous Publications

MP-35 Nebraska Mineral Operations Review, 1992, R. R. Burchett and D.A. Eversonn - $1.00

General Information Maps and Charts

GIM-21 Crow Butte Uranium Deposit, 2 pp., R. R. Burchett and D.A. Eversoll - $1.00

GIM-44 Uranium Deposits in Nebraska, 3 pp., R. R. Burchett (1990 - Revised 1993)

GIM-52 Geology of Arbor Day Farm, Nebraska City, Nebraska, 7 pp., R. R. Burchett and D.A. Eversoll

GIM-53 Niobrara River Basin Geological References (Including Parts of South Dakota Both in and Outside of the Basin), 10 pp., P.E. Helland and R.F. Diffendal, Jr.

GIM-54 Native Vegetation Map of Nebraska, R.B. Kaul and S.B. Rolfsmeier - $3.50

Open-File Reports

Geological Field Guide to Cedar Point Biological Station, Keith County, 1979, Revised 1993, R.F. Diffendal, Jr. and R.K. Pabian, 26 pp.

Other

Resource Notes, 1992-93 Annual Report of the Conservation and Survey Division, Vol. VII, 37 pp. - Free

Resource News, 1993, Quarterly Newsletter of the Conservation and Survey Division, 3 issues, 4 pp. each - Free

1994

Water Supply Papers

WSP-72 Groundwater-level Changes in Nebraska, 1992, G.V. Steele (USGS), and P.B. Wigley (CSD), 6 pp - $3.50

Test-Hole Reports

THR-13 Cass County Test-Hole Log Book, R.R. Burchett and F.A. Smith, (1989: revised 1994) 168 pp - $8.50

THR-18 Clay County Test-Hole Log Book, R.R. Burchett and F.A. Smith, 35 pp - $4.00

THR-80 Seward County Test-Hole Log Book, R.R. Burchett and F.A. Smith, (1989: revised 1994) 48 pp - $4.50

Soil Surveys

SS-184 Banner County - $3.50

Resource Reports

RR- Directory of Quarries, Pits and Mines in Nebraska, R.R. Burchett and D.A. Eversoll (computer printout) - $10.00

Educational Circulars

EC-11 Fundamentals of Groundwater Contamination, D.T. Pederson, 18 pp - $4.50

EC-12 Banded Agates--Origins and Inclusions, R.K. Pabian, (CSD), and A. Zarins (formerly of DEQ), 32 pp - $4.50

Geological Survey Investigations

GSI-9 Geologic Framework of the Niobrara River Drainage Basin and Adjacent Areas in South Dakota Generally East of the 100th Meridian West Longitude and West of the Missouri River, R.F. Diffendal, Jr. and M.R. Voorhies, 13 pp - $3.00

General Information Maps and Charts

GIM-23 Earthquakes in Nebraska, R.R. Burchett, (1990: revised 1994) 2 pp - $0.50

GIM-38 Mineral Facts for Nebraska, R.R. Burchett, (1991: revised 1994) 7 pp - $0.50

GIM-47 Oil and Gas Facts for Nebraska, R.R. Burchett, (1991: revised 1994) 8 pp - $0.50

GIM- Nebraska Department of Environmental Quality Title 132 -- Rules and Regulations Pertaining to Solid Waste Management in Seismic Impact Zones, R.R. Burchett, compiler - Free

GIM-76 Samples of Nebraska's Common Rocks: Compiled by R.R. Burchett, D.R. Mohlman, R.K. Pabian, B. Penas and R. Vasek. Two collections of Nebraska's most common rocks, both with accompanying brochures, one set designed for K-12 science education, and one set designed primarily for advanced scientific study at the post-high school level. Both come in a clear plastic box - $5.00 per set.

Miscellaneous Publications

MP-36 Nebraska Mineral Operations Review, 1993, R.R. Burchett and D.A. Eversoll, 15 pp - $2.00

MP-38 Nebraska Earth Science Education Network Membership Directory and Information Guide, Compiled by D.R. Mohlman, D.C. Gosselin, and F.B. Belohlavy, 37 pp - Free

Open-file Reports

GIS Data Base and Assessment of the Physical Natural Resources of the Cedar River Basin, Nebraska, A.M. Matherne, R.R. Burchett and J.F. Ayers - 116 pp.

Cooperative Series with USGS

Preliminary Results of the Coal Properties and the Potential for Coal-bed Methane in the Forest City Basin, J.L. Bostic, L. Lawrence, M.R.Howes, R.R. Burchett, and B.S.Pierce, United States Geological Survey Open-file Report No. 93-576.

Other

CSD Publications catalog, includes open-file and contract reports, theses and dissertations and an index, compiled by D.R. Mohlman and C.A. Flowerday, 108 pp - Free

Resource Notes, 1993-94 Annual Report of the Conservation and Survey Division, Vol. VIII, 31 pp. - Free

Resource News, 1994, Newsletter of the Conservation and Survey Division, 3 issues, 4 pp. each - Free

1995 (To Date)

Test-Hole Reports

THR-8 Boyd County Test-Hole Log Book, S. Olafsen Lackey, F. Smith and R.R. Burchett - $5.50

Guidebooks

GB-10 Geologic Field Trips in Nebraska and Adjacent Parts of Kansas and South Dakota, R.F. Diffendal, Jr. and C.F. Flowerday, editor, - $5.50

General Information Maps and Charts

GIM-21 Crow Butte Uranium Deposit, R.R. Burchett (1990: revised 1995), 2 pp.

GIM-38 Mineral Facts for Nebraska, R.R. Burchett (1992: revised 1995), 15 pp.

GIM-47 Oil and Gas Facts for Nebraska, R.R. Burchett (1992: revised 1995), 8 pp.

Miscellaneous Publications

MP-37 Guidelines for Decommissioning Water Wells, D.A. Eversoll, D.R. Hay and R.J. Tremblay - price TBA

MP-38 Nebraska Earth Science Education (NESEN) Resources Guide and Directory, second edition, D.R. Mohlman, J. Dial, D.C. Gosselin and F.V. Belohlavy - free

ARTICLES BY

CONSERVATION AND SURVEY

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1989 - 1995

1989

Refereed Journals

Ayers, J.F., "Application and Comparison of Shallow Seismic Methods in the Study of an Alluvial Aquifer," Ground Water, Vol. 27, No. 5, pp. 625-632.

Ayers, J.F., "Conjunctive Use of Geophysical and Geological Data in the Sudy of an Alluvial Aquifer," Ground Water, Vol. 27, No. 4, pp. 550-563.

Laul, J.C., **D.C. Gosselin**, K.C. Galbreath, S.B. Simon, and J.J. Papike, "Chemistry and Petrology of Apollo 17 Highland Coarse Fines: Plutonic and Melt Rocks," Proceedings, 19th Lunar Planetary Science Conference, pp. 85-97.

Laul, J.C., M.R. Smith, T.C. Maiti and **D.C. Gosselin**, "Natural Radionuclides in Groundwaters and Cores," Radioactive Waste Management and the Nuclear Fuel Cycle, Vol. 13, pp. 349-365.

Rundquist, D.C. and L. Di, "Band-Moment Analysis of Imaging-Spectrometer Data," Photogrammetric Engineering and Remote Sensing, Vol. 55, No. 2, February, pp. 203-208.

Rundquist, D.C., R.O. Hoffman, **M.P. Carlson**, and A. Cook, "The Nebraska Center-Pivot Inventory: An Example of Operational Remote Sensing on a Long-Term Basis," Photogrammetric Engineering and Remote Sensing, Vol. 55, No. 5, May, pp. 587-590.

Spalding, R.F., M.E. Burbach, and **M.E. Exner**, "Pesticides in Nebraska's Ground Water," Ground Water Monitoring Review, Vol. 9 No. 4, pp. 26-133.

Books/Chapters in Books

Laul, J.C., and **D.C. Gosselin,** "Radioanalytical Methods for Rare Earth Elements in Geological and Biological Materials," In Lanthanide Probes in Life, Chemical and Earth Sciences, J-C.G. Bunzli and G.R. Choppin, eds, pp. 351-389.

Merchant, J.W., "Teaching Digital Data Analysis Strategies," In Current Trends in Remote Sensing Education, M.D. Nellis, R. Lougeay, and K. Lulla, eds, pp. 65-80.

Proceedings

Carr, J., **D.T. Pederson**, T.R. Shepherd, and D. Duncan, "Use of Atrazine to Measure Induced Recharge in the Lincoln Wellfield," Crop Pest Mangement Update Conference, Cooperative Extension, IANR, pp. 117-118.

Published Abstracts

Carlson, M.P., "The Influence of the Midcontinent Rift System on the Occurrence of Oil in the Forest City Basin," American Association of Petroleum Geologists Bulletin, Vol. 73, No. 3, p. 340.

Carlson, M.P., "Transcontinental Arch - Backbone of North America," 28th International Geological Congress Abstracts, Vol. 1, pp. 238.

Carlson, M.P., "Petroleum Potential of Lower and Middle Paleozoic Rocks in the Nebraska Portion of the Midcontinent," American Association of Petroleum Geologists Bulletin, Vol. 73, No. 8, pp. 1044-1045.

Carlson, M.P., S.B. Treves, and J.B. Swinehart, "Keweenawan Sediments in a Well-Core in Eastern Nebraska," Geological Society of America North-Central Meeting, Abstracts with Program, Vol. 24, No. 4, p. 8.

D'Angelo, M. J. Schalles, and **D.C. Rundquist**, "Assessing Littoral Habitat Structure Based on a Classification of Solar Reflectance Spectra," Annual Meeting, Nebraska Academy of Sciences.

Diffendal, R.F., Jr., and **J.B. Swinehart**, "Tertiary Fluvial Systems of Western and Central Nebraska U.S.A.," 4th International Fluvial Sedimentology Conference Abstracts, p. 123.

Diffendal, R.F., Jr. and M.B. Leite, "Late Quaternary Alluvial and Lacustrine Fills, Keith and Garden Counties, Nebraska - the Conundrum Reconsidered," TER-QUA `89,' Program with Abstracts, p. 13.

Duncan, D.G., T.R. Shepherd, **D.T. Pederson**, and J.D. Carr, "Atrazine as a Tracer of Induced Recharge into an Alluvial Aquifer Along the Platte River near Ashland, Nebraska," Geological Society of America Abstracts with Program, Vol. 21, No. 6, p. A43.

Exner, M.E. "Impact of an Artificial Recharge Structure on Pesticide Concentrations in the Adjacent Groundwater," U.S. Geological Survey Second National Symposium on Water Quality: Abstracts of the Technical Sessions, U.S. Geological Survey Open-File Report 89-409, p. 111.

Fraser, R., J. Schalles, L. Han, F. deNoyelles, **D.C. Rundquist,** and D. Goodin, "Detection and Monitoring of Atrazine Toxic Effects on Phytoplankton Communities by Remote Sensing," Annual Meeting, Nebraska Academy of Sciences.

Gosselin, D.C. and J.C. Laul, "Chemistry of Allan Hills 85085: Characterization of a Unique Chondrite," Lunar Planet Science, Vol. XX, pp. 349-350.

Han, L., T. Josephson, L. Yang, and **D.C. Rundquist**, "The Comparison of Diffuse Reflectance and Specular Reflectance of Clear and Turbid Water," Annual Meeting, Nebraska Academy of Sciences.

Laul, J.C., **D.C. Gosselin**, and M.R. Smith, "The Bholghati Consortium: Chemical Study of the Bholghati Howardite," Lunar Planet Science, Vol. XX, pp. 558-559.

Lowrie, A., and **R.F. Diffendal, Jr.**, "Application of Marine Sealevel Stratigraphy to Neogene Great Plains Stratigraphy," TER-QUA `89', Program with Abstracts, p. 8.

Pabian, R.K., R.F. Diffendal, Jr. and others, "Late Pennsylvanian and Early Permian Cyclic Sedimentation, Paleogeography, Paleo-ecology, and Biostratigraphy in Kansas and Nebraska," Missouri Div. of Geology & Land Survey Special Publication, Vol. 5, pp. 5-6.

Pabian, R.K. "Thoracic Development in the Trilobite Ditomopyge Scitula (Meek & Worthen) from the Basal Ervine Creek Limestone Member, Deer Creek Formation, Shawnee Group (Late Pennsylvanian, Virgilian) in Southeastern Nebraska," Nebraska Academy of Science 99th Annual Meeting, Proceedings, pp. 53-54.

Pederson, D.T., "Drought Impact on Water Quality: A Wellfield Example," Annual Fall Meeting of the American Geophysical Union, Transactions, Vol. 70, No. 43, p. 1120.

Schwartman, K.J., R.G. Goodwin, and **J.B. Swinehart,** "Composite Ichnofabrics of the Lower Whitney Ash Bed (Oligocene), Chimney Rock National Historic Site, Western Nebraska," 1989 Geological Society of America Annual Meeting, Abstracts with Programs.

Smith, M.R., D.W. Koppenaal, **D.C. Gosselin**, and J.C. Laul, "Direct Analysis of Geologic and Meteorite Samples Using Laser Ablation Inductively Coupled Mass Spectrometry," Lunar Planet Science, Vol. XX, pp. 1026-1027.

Research/Contract Reports

Ayers, J.F. "Hydrogeology of the Lower Platte Valley Alluvial Aquifer, Part I: Geoelectric Survey," Report to the City of Lincoln, Lincoln Water System, 117 pp.

Exner, M.E., "An Investigation to Determine the Source of Elevated Nitrate Concentrations in the Ground Water of the North Platte River Valley west of Oshkosh," Contract Report for the North Platte Natural Resources District.

Exner, M.E., B. Brown, S. Meyer and M. Unger, "Evaluation of the Potential for Pollution of the Groundwater in the Lower Platte Valley," in Water Quality in the Lower Platte River Basin with Emphasis on Agrichemicals, pp. A1-34, Contract Report for the City of Lincoln, the Metropolitan Utilities District, the City of Fremont and the Lower Platte North, Lower Platte South and Papio-Missouri River Natural Resources Districts.

Miscellaneous/Other

Exner, M.E., and R.F. Spalding, "Occurrence of Pesticides and Nitrate in Nebraska's Ground Water," Water Center Publication WC-1, University of Nebraska, 34 pp.

Pabian, R.K. and **R.F. Diffendal, Jr.**, compilers, "Late Pennsylvanian and Early Permian Cyclic Sedimentation, Paleogeography and Biostratigraphy in Kansas and Nebraska," Geological Society of America Guidebook, 75 pp.

1990

Refereed Journals

Ayers, J.F. "Shallow Seismic Refraction Methods Applied to a Ground Water Investigation on Nukuoro Atoll, Micronesia," Journal of Hydrology, Vol. 113, pp. 123-133.

Burchett, R.R., "Coal Resources of Nebraska," Coal Geology of the Interior Coal Province, Western Region, 1990 Annual Meeting of the Geological Society of America, Coal Geology Division Field Trip, published by Environmental and Coal Associates, pp. 128-145.

Diffendal, R. F., Jr., "The Sidney Gravel and Kimball Formation, Supposed Parts of the Ogallala Group (Neogene), are not Objectively Mappable Units," In Gustavson, T.C. ed., Geologic Framework and Regional Hydrology: Upper Cenozoic Blackwater Draw and Ogallala Formations, Great Plains, Texas Bureau of Economic Geology, pp. 23-38.

Exner, M.E., "Pesticide Contamination of Ground Water Artificially Recharged by Farmland Runoff," Ground Water Monitoring Review, Vol. 10, No. 1, pp. 147-159.

Gosselin, D.C. and J.C. Laul, "Chemical Characterization of a Unique Chondrite: Allan Hills 85085," Meteoritics, Vol. 24, pp. 81-87.

Gosselin, D.C., J.J. Papike, C.K. Shearer, and J.C. Laul, "Geochemistry and Origin of Archean Granites in the Black Hills, South Dakota," Canadian Journal Earth Sciences, Vol. 27, pp. 57-71.

Laul, J.C. and **D.C. Gosselin**, "The Bholghati Howardite Chemical Study," Geochimica Cosmochimica Acta, Vol. 54, pp. 2167-2175.

Pabian, R.K., with P.F. Holterhoff, "Paleoenvironmental Implications of a Pyritized Molluscan Fauna, Bennett Shale Member, Red Eagle Formation, (Lower Permian) Richardson County, Nebraska," The Compass of Sigma Gamma Epsilon, Vol. 67, No. 1, pp. 35-49.

Paul, S.E., B.W. Netzler, **R.R. Burchett,** P.H. Roberts, R. Peters, D.L. Gordon, and J.H. Mossler, "Oil and Gas Developments in North Mid-Continent in 1989," American Association of Petroleum Geologists Bulletin, Vol. 74, No. 10B, pp. 110-119.

Simon, S.B., J.J. Papike, **D.C. Gosselin**, J.C. Laul, S.S. Hughes, and R.A. Schmitt, "Petrology and Chemistry of Apollo 17 Regolith," Proceedings, 20th Lunar Planetray Science Conference, pp. 219-230.

Books/Chapters in Books

Burchett, R.R., "Exploration in Nebraska, 1989," in Mining Engineering, May Issue, pp. 448-49.

Esparza, L.E. and **R.R. Burchett**, "The Mineral Industry of Nebraska," Minerals Yearbook-1988, U.S. Bureau of Mines, 7 pp.

Merchant, J.W., "GIS in Agriculture," The 1990 GIS Sourcebook, Fort Collins, CO: GIS World, Inc., pp. 223-226.

Proceedings

Carlson, M.P., "Petroleum Potential of Lower and Middle Paleozoic Rocks in the Nebraska Portion of the Midcontinent," Proceedings, 1989 Midcontinent Section, American Association of Petroleum Geologists, Oklahoma City, OK.

Eversoll, D.A. and L. Han, "A Geographic Information System for Evaluating Landslide Potential in Nebraska," Proceedings, Mid-America GIS Symposium, Overland Park, KS.

Maps

Simms, P.K., compiler, "Precambrian Basement Map of Northern Midcontinent USA," with contributions from individual states, (Nebraska, **M.P. Carlson**), U.S. Geological Survey, Miscellaneous Investigation Series Map I-1853-A.

Published Abstracts

Ayers, J.F., "Conjunctive Use of Geophysical and Geological Data in the Construction of a Ground-Water Flow Model," 35th Annual Midwest Groundwater Conference, Program with Abstracts, p. 22.

Baxter, J. and **D.T. Pederson**, "1975 Regional Groundwater Model of Big Blue Basin in Nebraska Revisited: A Comparison and Analysis of Predicted and Actual Results," Geological Society of America, Abstracts with Program, Vol. 22, No. 7, p. A65.

Carlson, M.P., "Genetic Relationships Between the Precambrian Basement and Phanerozoic Tectonics, Midcontinent Region, North America," 9th International Conference on Basement Tectonics, Geological Society of Australia, Abstracts No. 26, p. 23.

Carlson M.P., "Faunal Zones and Transgression within the Sauk Sequence (Upper Cambrian-Lower Ordovician), Nebraska-Iowa Region," Geological Society of America, Abstracts, Vol. 22, No. 7, p. A320.

Cornwell, K. and **D.T. Pederson**, "Variations in Flow of Dismal River in North Central Nebraska as Related to Atmospheric Pressure Changes," Annual Fall Meeting of the American Geophysical Union, Transactions, Vol. 71, No. 43, p. 1327.

Davis, R. and **D.T. Pederson**, "Modeled and Actual Patterns of Groundwater Level Declines in Nebraska," 1990 Midwest Groundwater Conference, Program with Abstracts, p. 30.

Eversoll, D.A. and L. Han, "A Geologically Oriented Statewide Raster Geographic Information System for Assessing Landslide Potential," American Society for Photogrammetry and Remote Sensing, Denver, CO, Abstracts.

Eversoll, D.A., "Roadway Landslides in Nebraska," Association of Engineering Geologists 34th Annual Meeting, Chicago, IL, Abstracts.

Goodin, D., **D.C. Rundquist**, J. Schalles, F. deNoyelles, J. Peake, L. Han and P. Yamamoto, "Close-range Remote Sensing of Suspended Sediments and Atrazine-Stressed Freshwater Phytoplankton," Association of American Geographers, Great Plains-Rocky Mountain Division Annual Meeting.

Hibbs, B.J., **J.F. Ayers**, and J.M. Sharp, "Saline Contaminant Migration by Advection and Gravity-Driven Flow in a Shallow Alluvial Aquifer," National Water Well Association Annual Meeting.

Kuzila, M.S., D.C. Rundquist and J.A. Keiner, "A Simple Raster-Based GIS for Detection of Wetland Change," Agronomy Abstracts, p. 319.

Pabian, R.K., "Latest Pennsylvanian and Earliest Permian Cyclic Deposition in Southeastern Nebraska and Northeastern Kansas," Nebraska Academy of Sciences, Proceedings, p. 62.

Pederson, D.T. and K. Cornwell, "Threshold Factors Identified in Theory and Laboratory Studies Have Applicability to Discharge of Boiling Springs Located along the Dismal River in Nebraska," Annual Fall Meeting of the American Geophysical Union, Transactions, Vol. 71, No. 43, p. 1327.

Rundquist, D.C., J. Schalles, F. deNoyelles, D. Goodin, B. Hayes, M. Schlemmer and P. Yamamoto, "Visible and Near-Infrared Spectroradiometry of Turbidity and Chlorophyll Conditions in Manmade Ponds," American Society for Photogrammetry and Remote Sensing Annual Meeting, Denver, CO.

Rundquist, D.C., J. Schalles, F. deNoyelles, D. Goodin, B. Hayes, M. Schlemmer and P. Yamamoto, "Close-range Multispectral Remote Sensing of Turbidity and Chlorophyll Conditions in Manmade Ponds," Association of American Geographers Annual Meeting, Toronto, Canada.

Schalles, J., **D.C. Rundquist**, F. deNoyelles and B. Hayes, "High Spectral Resolution Remote Sensing Measurements of Chlorophyll and Suspended Sediments Using Pond Dilution Manipulations," Ecological Society of America Annual Meeting, Snowbird, UT.

Schalles, J. **D.C. Rundquist** and F. DeNoyelles, "The Use of Field Spectroscopy to Estimate Algal Chlorophyll," Great Plains Limnology Society Annual Meeting, Stillwater, OK.

Schalles, J. and **D.C. Rundquist**, "High Spectral Resolution Remote Sensing for Monitoring Water Quality Indicators," Society for Environmental Toxicology and Chemistry Annual Meeting, Washington, D.C.

Shepherd, T.R., J.D. Carr, D. Duncan, and **D.T. Pederson,** "Atrazine Motion as an Indication of Movement in Subsurface Waters," Nebraska Academy of Sciences Annual Meeting, Proceedings, p. 50.

Souders, V.L. and **M.S. Kuzila**, "A Report on the Geology and Radiocarbon Ages of Four Superimposed Horizions at a Site in the Republican River Valley, Franklin County, Nebraska," Nebraska Academy of Sciences Annual meeting, Proceedings.

Swinehart, J.B. and **J.W. Goeke**, "Implications of a Modern Volcaniclastic Dust Fall at North Platte, Nebraska," Nebraska Academy of Sciences Annual Meeting, Proceedings, p. 65.

Research/Contract Reports

Ayers, J.F., "Hydrogeology of the Lower Platte Valley Alluvial Aquifer, Part II. Groundwater Flow Model Update," Report to the City of Lincoln, Lincoln Water System, 238 pp.

DaMoude, D.W., R. Honeman, **M.S. Kuzila**, J. Stecker, D.E. Ulrich and C.E. Morris, "Soil Survey of Saline County, Nebraska," USDA Soil Conservation Service, 160 pp.

Shurtliff, D.R., V.C. Seevers and **F.V. Belohlavy**, "Soil Survey of Loup County, Nebraska," USDA Soil Conservation Service, 190 pp.

Wahl, F.E., L.G. Ragon, P.D. Young and **M.S. Kuzila**, "Soil Survey of Sherman County, Nebraska," USDA Soil Conservation Service, 163 pp.

1991

Refereed Journals

Exner, M.E., M.E. Burbach, D.G. Watts, R.C. Shearman, and R.F. Spalding, "Deep Nitrate Movement in the Unsaturated Zone of a Simulated Urban Lawn," Journal of Environmental Quality, Vol. 20, No. 3, pp. 658-662.

Di, L. and **D.C. Rundquist**, "A Classification-Based Method for Color-Composite Image Generation," GeoCarto Internation, Vol. 6, No. 2, June, pp. 23-30.

Di, L. and **D.C. Rundquist,** "Instantaneous Three-Channel Image Processing," Photogrammetric Engineering and Remote Sensing, Vol. 57, No. 3, March, pp. 305-311.

Diffendal R.F., Jr., "Plate Tectonics, Space, Geologic Time and the Great Plains - a Primer for Non-Geologists," Great Plains Quarterly, Vol. 11, No. 2, pp. 83-102.

Duncan, D., **D.T. Pederson,** T.R. Shepherd, and J.D. Carr, "Atrazaine Used as a Tracer of Induced Recharge," Ground Water Monitoring Review, Vol. XI, No. 4, pp. 144-150.

Kuzila, M.S., D.C. Rundquist, and J.A. Green, "Some Methods for Estimating Wetland Loss: the Rainbasin Region of Nebraska, 1927-1981," Journal of Soil and Water Conservation, Vol. 46, No. 6, November-December, pp. 441-446.

Loveland, T.R., **J.W. Merchant**, D.O. Ohlen, and J.F. Brown, "Development of a Land-Cover Characteristics Database for the Conterminous U.S.," Photogrammetric Engineering & Remote Sensing, Vol. 57, No. 11, November, pp. 1453-1463.

Peters, A.J., **D.C. Rundquist**, and D.A. Wilhite, "Satellite Detection of the Geographic Core of the 1988 Nebraska Drought," Agriculture and Forest Meteorology Vol. 57, pp. 35-47.

Rundquist, D.C., D.A. Rodekohr, A.J. Peters, R.L. Ehrman, L. Di and G. Murray, "Statewide Groundwater-Vulnerability Assessment in Nebraska Using the DRASTIC/GIS Model," GeoCarto International, Vol. 6, No. 2, June, pp. 51-58.

Books/Chapters in Books

Carlson, M.P., "Distribution and Age of Dolomitic Hematitic Oolites Near the Ordovician-Silurian Boundary in Nebraska and Kansas," Geoscience Wisconsin, Vol. 14, pp. 65-72.

Spalding, R.F., **M.E. Exner** and M.E. Burbach, "Economical Monitoring Procedure for Assessing Agrochemical Nonpoint Source Loading in Unconsolidated Aquifers," In Groundwater Residue Sampling Design, R.G. Nash and A.R. Leslie, eds., pp. 255-261, ACS Symposium Series No. 465, American Chemical Society, Washington, D.C.

Spalding, R.F. and **M.E. Exner**, "Nitrate Contamination in the USA," In Nitrate Contamination: Exposure, Consequences and Control, I. Bogardi and R. Kuzelka, eds., pp. 13-48, Springer-Verlag Publishing Company.

Starch, K.S. and **R.R. Burchett**, "The Mineral Industry of Nebraska," Minerals Yearbook-1989, U.S. Bureau of Mines, 7 pp.

Proceedings

Kuzila, M.S. and C.A. Flowerday, "Wetlands Determination: Ambiguity, Education and Local Involvement," Proceedings, A Lake is a Reflection of Its Watershed, Regional Lake Management Conference, Des Moines, IA, pp. 82-100.

Maps

Carlson, M.P., Nebraska Author for "Alkaline Igneous Rocks, Carbonatites and Peridotites, Northern Midcontinent, USA," U.S. Geological Survey, Miscellaneous Field Studies Maps, MF-1835F.

Carlson, M.P., Nebraska Author for "Lithologic Cross Sections of Phanerozoic Rocks in the Northern Midcontinent, USA," U.S. Geological Survey, Miscellaneous Field Studies Maps, MF-1835G.

Diffendal, R.F., Jr., "Geologic Map Showing Configuration of the Bedrock Surface, North Platte 1 x 2 degree Quadrangle, Nebraska," U.S. Geological Survey, Miscellaneous Investigations Map I-2277.

Hallberg, G.R., J.A. Lineback, D.M. Mickelson, J.C. Knox, J.E. Goebel, J.E. Hobbs, H.C. Hobbs, J.W. Whitfield, R.A. Ward, J.B. Boellstorff, **J.B. Swinehart** and V.H. Dreeszen, "Quaternary Geologic Map of the Des Moines 4 x 6 degree Quadrangle, USA", In, G.M. Richmond, D.S. Fullerton and A.C. Christenson, eds., Quaternary Geologic Atlas of the United States, U.S. Geological Survey, Miscellaneous Investigation Series, Map I-1420.

Simms, P.K., compiler, "Precambrian Basement Map of the Trans-Hudson Orogen and Adjacent Terranes, Northern Great Plains, USA," with contributions from individual states (Nebraska, **M.P. Carlson**), U.S. Geological Survey Miscellaneous Investigation Series Map I-2214.

Published Abstracts

Ayers, J.F., "Use of Geophysical and Geological Data in the Construction of a Groundwater Flow Model," Symposium on the Application of Geophysics to Engineering and Environmental Problems, Knoxville, TN.

Ayers, J.F., Y.K. Zhang and **D.C. Gosselin**, "Water-Sampling Regime Around High-Capacity Wells -- An Analysis," Geological Society of America, Abstracts with Program, Vol. 23, p. A326.

Ayers, J.F., D.C. Gosselin and Y.K. Zhang, "Water Samples from Irrigation Wells -- How Representative Are They?", 36th Annual Midwest Groundwater Conference, Program with Abstracts, p. 48.

Carlson, M.P., "Hydrothermally Altered Conodonts, Forest City Basin, Nebraska," Geological Society of America, Abstracts with Program, Vol. 23, No. 5, p. A414.

Carlson, M.P., "The Oil Industry in Nebraska, Historical and Geological Patterns," American Association of Petroleum Geologists Midcontinent Meeting, Wichita, KS.

Carlson, M.P., "Significant Biostratigraphic Occurrences in the Lower and Middle Paleozoic Rocks in the Subsurface of Nebraska," Abstracts, Nebraska Academy of Sciences.

Davis, R.K., A.M. Ghazi, **D.T. Pederson** and R.J. Goble, "Trace Element Variation Pattern Under Induced Recharge near the Platte River, Lincoln Municipal Wellfield, Ashland, Nebraska: As Determined by ICP-MS," Geological Society of America, Abstracts with Program, Vol. 23, No. 5, p. A268.

Davis, R.K., **D.T. Pederson**, D.A. Blum and J.D. Carr, "Atrazine Movement Under Induced Recharge from the Platte River, Lincoln Wellfield, Ashland, Nebraska," American Geophysical Union Annual Fall Meeting Transactions, Vol. 72, No. 44, p. 185.

Eversoll, D.A., "Identification and Classification of Roadway Landslides in Nebraska," Geological Society of America Annual Meeting, Abstracts with Program, Vol. 23, No. 5.

Gardner, L.R., D.F. Williams, P. Helland and **R.F. Diffendal, Jr.**, "Stable Isotope Composition of Calcareous Paleosols from the Ogallala Group (Neogene), Western Nebraska," American Geophysical Union Chapman Conference on Continental Isotope Indicators of Climate, 2 pp.

Gardner, L.R., D.F. Williams, P. Helland and **R.F. Diffendal, Jr.**, "Current Studies on Climate at Source Areas and Depositional Sites During Latest Ogallala Group (Late Neogene) Deposition, Western Nebraska," TER-QUA '91, Program with Abstracts, p. 7.

Gosselin, D.C., **A.M. Matherne**, **J.F. Ayers**, and **S. Sibray**, "Geochemical Characteristics of Alkaline Lakes in the Western Sand Hills, Nebraska," Geological Society of America, Abstracts with Program, Vol. 23, p. A153.

Gosselin, D.C. and **J.F. Ayers**, "Hydraulic Influences on the Distribution of Agrichemicals within a Groundwater System," 36th Midwest Groundwater Conference, Program with Abstracts, Vol. 21.

Helland, P. and **R.F. Diffendal, Jr.**, "Scanning Electron Microscopic Study of Quartz Sand Surface Features, Ash Hollow Formation, Ogallala Group, Western Nebraska," Nebraska Academy of Sciences 101st Annual Meeting, Proceedings, pp. 57-58.

Pabian, R.K., "Chaos and Fractals as Explanations for the Origins of Certain Structures in Agates," Nebraska Academy of Sciences Annual Meeting, Proceedings.

Pabian, R.K., "Development and Distribution of Resources for Earth Science Teachers of Nebraska," Geological Society of America, North Central Section Annual Meeting, Abstracts with Program, Toledo, OH.

Pabian, R.K., "Generic Reorganization and Replacement of Crinoids Through the Ervine Creek-Curzon Inverval (Upper Pennsylvanian, Virgilian) of S.E. Nebraska and S.W. Iowa," Geological Survey of America, North Central Section Annual Meeting, Abstracts with Program, Toledo, OH.

Prothero, D., T. Tierney, C. Swisher, and **J.B. Swinehart**, "Magnetostratigraphy and Geochronology of the Late Oligocene Gering Formation, Nebraska: Implications for the Arikareean," Geological Society of America Annual Meeting, Abstracts with Program, p. A420.

Rundquist, D.C., J. Schalles and J. Peake, "The Effect of Turbidity and Chlorophyll Concentration on Reflectance from Submerged Targets," American Society for Photogrammetry and Remote Sensing Annual Meeting, Baltimore, MD.

Schalles, J., **D.C. Rundquist**, F. deNoyelles and J. Peake, "The Use of Spectroradiometry and Black and White Targets to Probe Solar Reflectance Relationships to Unit Volume and Unit Area Algal Chlorophyll Abundance," Ecological Society of America Annual Meeting, Toronto, Canada.

Swinehart, J.B., "Holocene Eolian Dune Activity in the Nebraska Sand Hills -- More Than Skin Deep," Geological Society of America Annual Meeting, Abstracts with Program, p. A284.

Research/Contract Reports

Ayers, J.F., "Well-head Protection Areas, Lincoln Well Field, Ashland Nebraska," Report to the City of Lincoln, Lincoln Water System, 31 pp.

Exner, M.E., and R.F. Spalding, "Trend Analysis of Ground-water Quality in Holt County Within the Upper Elkhorn Natural Resources District," Contract Report for the Upper Elkhorn Natural Resources District, Water Center Report WC/WSL 91-2, 13 pp.

Eversoll, D.A., "Landslide Inveentory Along Nebraska State-Federal Roadway System," Contract Report to Nebraska Department of Roads, RESI (0099), 43 pp.

1992

Refereed Journals

Burchett, R.R. , "Niobrara Gas Indications Cover Wide Area of Western Nebraska," Oil and Gas Journal, May 11, 1992.

Gardner, L.R., **R.F. Diffendal, Jr.**, and D.F. Williams, "Stable Isotope Composition of Calcareous Paleosols and Ground-Water Cements from the Ogallala Group (Neogene) Western Nebraska," University of Wyoming Contributions to Geology, Vol. 29, No. 2, pp. 97-109.

Gosselin, D.C., M.R. Smith, E.A. Lepel, and J.C. Laul, "Rare Earth Elements in Chloride-Rich Groundwater, Palo Duro Basin, Texas, U.S.A.," Geochimica Cosmochimica Acta, Vol. 56, pp. 1495-1505.

Guhman, A. and **D.T. Pederson**, "Boiling Sand Filled Artesian Springs, Dismal River, Nebraska: Agents for Geomorphic Change and Formation of Vertical Cylindrical Structures," Geology, Vol. 20, No. 1, pp. 8-10.

Narayanan, R.M., D.W. Doerr, **D.C. Rundquist**, "Temporal De-correlation Characteristics of X-Band Microwave Backscatter from Wind-Influenced Vegetation," IEEE Transactions on Aerospace and Electronics Systems, Vol. 28, No. 2, April, pp. 404-412.

Peters, A.J., B.C. Reed, and **D.C. Rundquist**, "A Technique for Processing NOAA-AVHRR Data into a Geographically Referenced Image-Map," Photogrammetric Engineering and Remote Sensing, Vol. 58, No. 5, May, pp. 569-571.

Shepherd, T.R., J.D. Carr, D. Duncan, and **D.T. Pederson**, "C-18 Extraction of Atrazine from Small Water Sample Volumes," Journal of Association of Official Analytical Chemistry, Vol. 75, No. 3, pp. 581-583.

Tabidian, A., **D.T. Pederson**, and P.A. Tabidian, "A Paleovalley Aquifer System and its Interaction with the Big Blue River of Nebraska during a Major Flood," The Future Availability of Ground Water Resources Symposium Series, AWRA Tech. Publication Series TPS-92-1, pp. 165-172.

Non-Refereed Journals

Merchant, J.W., "A Perspective on the State of GIS in the United States," Geodetical Info Magazine, October, pp. 47-53.

Books/Chapters in Books

Starch, K.S., and **R.R. Burchett**, "The Mineral Industry of Nebraska," Minerals Yearbook--1990, U.S. Bureau of Mines, p. 7.

Proceedings

Goodin, D.G. and **D.C. Rundquist**, "Estimating Surface Albedo in Alpine Tundra Using the Landsat Thematic Mapper and Digital Terrain Data," International Society for Photogrammetry and Remote Sensing Commission VII Proceedings.

Han, L., **D.A. Eversoll,** and **D.C. Rundquist**, "Evaluating Landslide Susceptibility in Nebraska with a GIS," International Archives of Photogrammetry and Remote Sensing, Proceedings, Vol. 29, No. 3, pp. 91-93.

Narayanan, R.M., S.R. Jackson, and **D.C. Rundquist**, "Simulation of Millimeter-Wave Radar Clutter Maps of Snow Surfaces," Southeastern Simulation Conference, Proceedings, pp. 10-19.

Narayanan, R.M., R. Pardipuram, and **D.C. Rundquist**, "Spatial Statistical Characteristics of Simulated Radar Imagery from Bare Soil Surfaces: Effects of Surface Roughness and Soil Moisture Variability," International Geoscience and Remote Sensing Society, Proceedings, pp. 498-500.

Price, K.P., V.C. Varner, E.A. Martinko, and **D.C. Rundquist**, "Analysis of Multitemporal Narrow-Band Spectroradiometer Measurements from Six Prairie Treatments in Kansas," American Society for Photogrammetry and Remote Sensing, Proceedings, pp. 372-385.

Maps

Carlson, M.P., "Maps Showing Areal Extent of Selected Paleozoic Shales in the Northern Midcontinent, U.S.A.," U.S. Geological Survey, Miscellaneous Field Studies Maps, MF-1835H.

Published Abstracts

Carlson, M.P., S.B. Treves and **J.B. Swinehart**, "Keweenawan Sediments in a Well-Core in Eastern Nebraska," Geological Society of America North Central Meeting, Abstracts with Program, Vol. 24, No. 4.

Carlson, M.P., "Tectonic Implications and Influence of the Midcontinent Rift System in Nebraska and Adjoining Areas," 10th International Conference on Basement Tectonics, Duluth, MN.

Davis, R.K., **D.T. Pederson**, D.A. Blum, and J.D. Carr, "Hydrologic Controls on the Movement of Atrazine via Induced Recharge from the Platte River into Lincoln's Municipal Well Field Near Ashland, Nebraska," 37th Annual Midwest Ground Water Conference, Sioux Falls, SD, Program with Abstracts, p. 29.

Davis, R.K., **D.T. Pederson**, D.A. Blum, and J.D. Carr, "Hydrologic Controls on the Movement of Atrazine via Induced Recharge from the Platte River into Lincoln's Municipal Well Field," Nebraska Academy of Sciences, Proceedings, p. 65.

Diffendal, R.F., "Synthetic-Aperture Radar Imagery and Digital Shaded Relief Map of Northwest Nebhraska - Probable Structures and Geomorphic Features of the Region," Nebraska Academy of Sciences, 102nd Annual Meeting, Proceedings, pp. 66-67

Gosselin, D.C., "An Overview of Archean Rocks in the Black Hills, South Dakota, Rocky Moutain Section," Geological Society of America, Abstracts with Program, Vol. 15.

Loope, D.B. and **J.B. Swinehart**, "Dune-Dammed Lakes of the Nebraska Sand Hills: Geologic Setting and Paleoclimatic Implications," Geological Society of America Annual Meeting, Abstracts with Program, Vol. 24, No. 7, p. A180.

Loveland, T.R., **J.W. Merchant**, D. Ohlen and J.F. Brown, "A Land Cover Characteristics Data Base for the Conterminous U.S.," Association of American Geographers Annual Meeting, San Diego, CA, Abstracts Volume, p. 141.

Loveland, T.R., **J. W. Merchant**, J.F. Brown and D.O. Ohlen, "Multisource Data Requirements for Large-Area Land Cover Characterization," American Society for Photogrammetry and Remote Sensing, Technical Papers ASPRS/ACSM/RT 92, Vol. 4, p. 491.

Matherne, A.M., D. C. Gosselin, and J. Ayers, "The Role of Groundwater in Maintaining Saline Lakes, Western Nebraska Sandhills," American Geophysical Union EOS Supplement, Vol. 73, No. 14, p. 132.

Merchant, J.W., "Issues in Characterizing Landscape Structure Using Satellite Data," U.S. Landscape Ecology Symposium, Abstract Volume, p. 93.

Merchant, J.W., "Landscape Edge Representation in Satellite Imagery: A Taxonomic Approach," Association of American Geographers Annual Meeting, San Diego, CA, Abstracts Volume, p. 161.

Meyers, M.R., D.B. Loope, and **J.B. Swinehart**, "A Pliocene Eolian Sand Sheet, Central Sand Hills Region, Nebraska," Geological Society of America North Central Section Meeting, Abstracts with Program, Vol. 24, No. 4, p. 8.

Pabian, R.K. with A. Zarins, "Stratigraphic Distribution and Environments of Deposition Relating to the Origin of Banded Agates," Geological Society of America North Central Section Meeting, Abstracts with Program, Vol. 24, No. 4, p. 58.

Pabian, R.K. with A. Zarins, "Accessory Mineralization in Amygdaloidal Agates: An Overview," Nebraska Academy of Sciences, 112th Annual Meeting, Abstracts, p. 70.

Pederson, D.T., W.J. Wayne, and R.K. Davis, "Model for Sand Hills Development: Geometry, Sediment Supply and Deposition, River Systems and Climatic Implications," Geological Society of America, Abstracts with Program, Vol. 24, No. 7, p. A296.

Pederson, D.T., "Origin of Boiling Sand Springs along the Dismal River, Nebraska Sand Hills: Rapid Entrenchment of Dismal River Channel," American Geophysical Union Annual Fall Meeting, Transactions, Vol. 73, No. 42, p. 232.

Price, K. V. Varner, E. Martinko, and **D.C. Rundquist**, "Analysis of 252-Band Spectroradiometer Data to Spectrally Characterize Selected Prairie Types in Kansas," Kansas Academy of Science Annual Meeting.

Price, K., V. Varner, E. Martinko, and **D.C. Rundquist**, "Analysis of Multitemporal Spectroradiometer Measurements for Six Prairie Treatments," American Association of Geographers Annual Meeting.

Rundquist, D.C., J. Schalles, L. Han, C. Keithley, and R. Fraser, "Progress in Remote Optical Characterization and Classification of Lakes in the Sand Hills of Nebraska," Association of American Geographers Annual Meeting.

Schalles, J., **D.C. Rundquist,** J. Arnhold, R. Horner, C. Mayne, and P. McConnell, "The Effects of Different Suspended Sediments on Phytoplankton Reflectance," Great Plains Limnology Society Annual Meeting.

Schalles, J. **D.C. Rundquist**, L. Han, and J. Peake, "Spectral Measures of Chlorophyll when Suspended Sediment Occurs," American Society of Limnology and Oceanography Annual Meeting.

Swinehart, J.B., and D.B. Loope, "A Giant Dune-Dammed Lake on the North Platte River, Nebraska," Geological Society of America Annual Meeting, Abstracts with Program, Vol. 24, No. 7, p. A51.

Swinehart, J.B., D.B. Loope, and Z. Yao, "Clay-Silt Bands and Associated Paleosols: Keys to Episodes of Dune Stability in the Nebraska Sand Hills," Geological Society of America North Central Section Meeting, Abstracts with Program, Vol. 24, No. 4, p. 67.

Varner, V., K. Price, E. Martinko, and **D.C. Rundquist**, "Analysis of Multitemporal Measurements of Prairie Bioproductivity Indicators and their Influence on Hyperspectral Reflectance Patterns," Great Plains/Rocky Mountain Division, Association of American Geographers Annual Meeting.

Weisenburger, D.D., F.A. Aullrich, **M.E. Exner**, R.F. Spalding, B.A. Buehler, and J.R. Anderson, "Birth Defects and Well Water Contamination by Agrichemicals: an Ecologic Study," the Third International Symposium on Issues in Health, Safety, and Agriculture, Proceedings, Saskatoon, Saskatchewan, Canada.

Research/Contract Reports

Carlson, M.P., with **S.S. Sibray**, and F.L. Mills, "Older Groundwater Reservoirs in Nebraska," Contract Report to Nebraska Department of Environmental Quality, 37 pp.

Exner, M.E., and R.F. Spalding, "Ground-Water Monitoring for Agrichemicals within the Lower Niobrara Natural Resources District," Lower Niobrara Natural Resources District, Water Center Report WC/WSL 92-1, 13 pp.

Voigtlander, A.L., R.R. Hammer, R.R. Zink, **M.K. Babcock**, B.C. Evans, M.D. Patterson and H. Schultz, "Soil Survey of Brown County, Nebraska," USDA Soil Conservaation Service, 272 pp.

Miscellaneous/Other

Diffendal, R.F., Jr., and 33 others, "NCAA Pilot Certification Self Study of UNL Athletic Department," 111 pp.

Diffendal, R.F., Jr., and 51 others, "Nebraska Energy Policy - Recommendations to the Governor," Nebraska Energy Office Report, 56 pp.

1993

Refereed Journals

Blum, A., D. J. Carr, R. Davis, and **D.T. Pederson** "Atrazine in a Stream-Aquifer System: Transport of Atrazine and its Environmental Impact Near Ashland, Nebraska," Ground Water Monitoring and Remediation, Vol. XIII, No. 2, pp.125-133.

Brown, J.F., T.R. Loveland, **J.W. Merchant**, B.C. Reed and D.O. Ohlen, "Using Multisource Data in Large-Area Land Cover Characterization: Concepts, Requirements and Methods," Photogrammetric Engineering and Remote Sensing, Vol. 59, No. 6, pp. 977-987.

Davis, R.K., **D.T. Pederson**, D.A. Blum, and J.D. Carr, "Atrazine in a Stream-Aquifer System: Estimation of Aquifer Properties from Atrazine Concentration Profiles," Ground Water Monitoring and Remediation, Vol. XIII, No. 2, pp.134-141.

Diffendal, R.F., Jr., and A. Lowrie, "Application of Sealevel Stratigraphy to Neogene Great Plains Stratigraphy," Gulf Coast Association of Geological Societies, Transactions, Vol. 43, pp. 121-129.

Goodin, D.G., L. Han, R. Fraser, **D.C. Rundquist**, and W.A. Stebbins, "Analysis of Suspended Solids in Water Using Remotely Sensed High Resolution Derivative Spectra," Photogrammetric Engineering and Remote Sensing, Vol. 59, No. 4, April, pp. 505-510.

Helland, P.E. and **R.F. Diffendal, Jr.**, "Probable Glacial Climatic Conditions in Source Areas During Deposition of Parts of the Ash Hollow Formation, Ogallala Group (Late Tertiary) of Western Nebraska," American Journal of Science, Vol. 293, pp. 744-757.

Kuzila, M.S. and D.T. Lewis, "Properties and Genesis of Loessial Soil Across a South-Central Nebraska Basin," Soil Science Society of America Journal, Vol. 57, pp. 155-161.

Pabian, R.K. with J. Borovich and R.H. Mapes, "Growth Stages of the Late Pennsylvanian Trilobite Ditomopyge Scitula (Meek and Worthen)," Journal of Paleontology, Vol. 67, No. 2, pp. 230-240.

Spalding, R.F. and **M.E. Exner,** "Occurrence of Nitrate in Ground Water: a Review," Journal of Environmental Quality, Vol. 22, No. 3, pp. 392-402.

Spalding, R.F., **M.E. Exner,** G.E. Martin, and D.D. Snow, "Effects of Sludge Disposal on Groundwater Nitrate Concentrations," Journal of Hydrology, Vol. 142, pp. 213-228.

Zlotnik, V.A., R.F. Spalding, **M.E. Exner**, and M.E. Burbach, "Sampling of Non-Point Source Contamination in High-Capacity Wells," Water Science and Technology, Vol. 28, pp. 3-5.

Non-Refereed Journals

Merchant, J.W., "Resource Materials for Teaching GIS," GeoInfo Systems, Vol. 3, No. 4, pp. 57-61, 68.

Books/Chapters in Books

Carlson, M.P. with K. D. Newell, "Stratigraphy and Petroleum Potential of the Hunton Group (Silurian-Devonian) in the Forest City Basin Area of Kansas and Nebraska," Oklahoma Geological Survey Special Publication 93-4, pp. 107-115.

Merchant, J.W. and J.B. Sharpe, "GIS Activities in State Government: A 1993 Update," GIS World, 1994 GIS Sourcebook, Ft. Collins, CO, GIS World, Inc., pp. 325-336.

Peterson, E.K. and **R.R. Burchett**, "The Mineral Industry of Nebraska," Minerals Yearbook--1991, U.S. Bureau of Mines, 7 pp.

Proceedings

Bostic, J.L., L.L. Brady, M.R. Howes, **R.R. Burchett**, and B.S. Pierce, "Preliminary Assessment of the Potential for Coalbed Methane in the Forest City Basin, Missouri, Kansas, Iowa and Nebraska," Pittsburg Coal Conference, Proceedings Volume: Coal-Energy and the Environment, pp. 1056-62.

Burchett, R.R., "The Role of the Nebraska Geological Survey in Post-Earthquake Investigations," Proceedings of Conference XLI, A Workshop held in St. Louis, MO, U.S.Geological Survey Open File Report 93-346, pp. 84-91.

Carlson, M.P., "Site Characterization - A Special Form of Risk Assessment," 15th Annual U.S. Department of Energy Low-Level Radioactive Waste Management Conference, Proceedings, Phoenix, AZ.

Diffendal, R.F., Jr., and M.R. Voorhies, "Geologic Framework of the Niobrara River Drainage Basin and Adjacent Areas in South Dakota Generally East of the 100th Meridian West Longitude and West of the Missouri River," Niobrara Basin Research Symposium, Proceedings, 8 pp and 12 pp addendum.

Price, K.P., V.C. Varner, E.A. Martinko, **D.C. Rundquist** and J.S. Peake, "Analysis of Multitemporal Narrow-Band Spectro-radiometer Measurements from Six Prairie Treatments in Kansas," Proceedings, American Society for Photogrammetry and Remote Sensing, Vol. 2, pp. 284-296.

Price, K.P., V.C. Varner, E.A. Martinko, **D.C. Rundquist**, and J.S. Peake, "Influences of Land Management and Weather on Plant Biophysical and Hyperspectral Response Patterns of Tallgrass Prairies in Northeastern Kansas," Proceedings, PECORA 12 Symposium, pp. 441-450.

Savage, W.Z., P.A. Bodin, M.E. Jackson and **D.A. Eversoll**, "Kinematics of the Slumgullion Earthflow, Southwest Colorado," Proceedings, American Geophysical Union Annual Meeting.

Spalding, R.F., M.E. Burbach, **R.F. Diffendal, Jr., M.E. Exner**, and T.D. Papiernik, "Analysis of Nitrate-Nitrogen Distribution Beneath Nebraska MSEA Blocks," Conference on Agricultural Research to Protect Water Quality, Proceedings, Soil and Water Conservation Society, pp. 314-317.

Zlotnik, V., M.E. Burbach, **M.E. Exner** and R.F. Spalding, "Sampling of Agricultural Contamination in High-Capacity Wells," Conference on Agricultural Research to Protect Water Quality, Proceedings, Soil and Water Conservation Society, pp. 321-323.

Published Abstracts

Burchett, R.R. and **M.P. Carlson**, "Current and Emerging Fossil-Energy Resources in Nebraska," American Association of Petroleum Geologists Mid-Continent Section Meeting, Amarillo, TX, Abstracts with Program, pp. 22-23.

Carlson, M.P., "The Influence of the Midcontinent Rift System on Known and Potential Mineral Resources in Nebraska," Geological Society of America Abstracts, Vol. 25, pp. 10-11.

Carlson, M.P., "Transcontinental Arch of North America -- Backbone or Skeleton?," Geological Society of America Abstracts, Vol. 25, p. A-471.

Carlson, M.P. and K. D. Newell, "Stratigraphy and Petroleum Production of the Simpson, Viola and Maquoketa in Kansas and Nebraska," Abstracts for Simpson and Viola Groups in the Southern Midcontinent, p. 4.

Felix, M.G. and **D.T. Pederson**, "Descriptive Correlation of Soil Vapor Extraction System Variables at the Hastings Ground Water Contamination Site," American Geophysical Union Annual Fall Meeting, Transactions, Vol. 74, No. 74, p. 240.

Fraser, R., L. Han, D. Goodin and **D.C. Rundquist**, "Multivariate Analysis of Remotely Sensed Spectra from Atrazine-Stressed Phytoplankton," Nebraska Academy of Sciences Annual Meeting.

Gosselin, D.C., J.F. Ayers, D.C. Rundquist, S. Sibray and **A.M. Matherne**, "The Alkali Lakes Project: A Multidisciplinary Investigation of a Dynamic Hydrologic and Geochemical System," Front Range Section, American Geophysical Union Annual Meeting, Abstracts, p. 11.

Gosselin, D.C., P. Nabelek and Z. Peterman, "Major Ion, O-18 and Sr Variations in K-Rich Lakes of the Alkali Lakes Region, Western Nebraska," Geological Society of America Annual Meeting, Abstracts with Program, p. A320.

Han, L. **D.C. Rundquist**, R. Fraser and L. Liu, "Responses of Both Surface Reflectance and the Underwater Light Field to Various Levels of Suspended Sediments," Nebraska Academy of Sciences 103rd Annual Meeting.

Liu, L., **D.C. Rundquist**, R. Fraser, L. Han and B. Tolk, "The Effect of Variable Water Depths on Spectral Measurements Acquired Over Rice Canopies," Nebraska Academy of Sciences 103rd Annual Meeting.

Loope, D.B., Zlotnik, V. and **J.B. Swinehart**, "Buried Paleovalleys in the Western Sand Hills: Do They Control Lake Chemistry," Nebraska Academy of Sciences 103rd Annual Meeting Proceedings.

Merchant, J.W., "Advanced Techniques for Landscape Region-alization," Association of American Geographers 89th Annual Meeting, Washington, D.C., Proceedings, p. 162.

Pabian, R.K., "Anal Sacs on Cromyocrinids from Nebraska and Kansas," Nebraska Academy of Sciences 103rd Annual Meeting, Proceedings, p. 42.

Spalding, R.F., M.E. Burbach, **R.F. Diffendal, Jr.**, **M.E. Exner**, and T. Papiernik, "Analysis of Nitrate-Nitrogen Distribution Beneath Nebraska MSEA Management Blocks," Conference on Agricultural Research to Protect Water Quality, Soil and Water Conservation Society Abstracts, p. 17.

Strivastav, P. and **D.T. Pederson**, "Wetland's Impact on Water Quality in Sandhills of Nebraska," Geological Society of America, Abstracts with Program, Vol. 25, No. 6, p. A-92.

Swinehart, J.B. and S. Stokes, "New Optical and Radiocarbon Dates Suggest Middle and Latest Holocene Dune Reactivation in the Nebraska Sand Hills," Nebraska Academy of Sciences 103rd Annual Meeting Proceedings.

Tabidian, M.A. and **D.T. Pederson**, "Quantification of the Impact of Irrigation Well Pumping on Baseflow to the Big Blue River: A Computer Model Case Study," AWRA 29th Annual Conference, Proceedings of Effluent Use Management Symposium, p. 216.

Tolk, B. **D.C. Rundquist**, L. Han, R. Fraser and L. Liu, "The Bottom Effect and Spectral Responses of Water at Various Turbidity Levels," Nebraska Academy of Sciences Annual Meeting.

Research/Contract Reports

Bostic, J.L., L.L Brady, M.R. Howes, **R.R. Burchett**, and B.S. Pierce, "Preliminary Results of the Coal Properties and Potential for Coal-Bed Methane in the Forest City Basin," U.S. Geological Survey Open-File Report No. 93-576.

Carlson, M.P., "Characterization of the Midcontinent Rift System in Nebraska," Contract Report to the U.S. Geological Survey, 14 pp.

Davis, R.K. and **D.T. Pederson**, "Water Resources Data and Suggestions for Water Code Development, Omaha Indian Reservation, Omaha Tribe of Nebraska," Investigative Report submitted to and accepted by Omaha Tribal Council, 81 pp.

Merchant, J.W., C. Keithley, and C. Erikson, "Mapping Cropland in Western Nebraska Using Landsat Thematic Mapper Satellite Imagery," Final Report to the Nebraska Department of Environmental Quality.

Shurtliff, D.R., V.C. Seevers, **F.V. Belohlavy**, B.C. Evans and **M.S. Kuzila**, "Soil Survey of Blaine County, Nebraska," USDA Soil Conservation Service, 174 pp.

Wilson, J.R., **F.V. Belohlavy**, J. Beck, R.S. Ohm and **W.C. Markley**, "Soil Survey of Greeley County, Nebraska," USDA Soil Conservation Service, 170 pp.

Miscellaneous/Other

Loveland, T.R., **J.W. Merchant** and others, "Conterminous United States Land Cover Characteristics Data Base," CD-ROM published by the U.S. Geological Survey.

Merchant, J.W., "Geographic Information Systems: An Update," Army Battlefield Environment, Vol. 10, No. 4, pp. 11-15.

1994

Refereed Journals

Diffendal, R.F., Jr., "Geomorphic and Structural Features of the Alliance 1 x 2 degree Quadrangle, Western Nebraska, Discernible from Synthetic-Aperture Radar Imagery and Digital Shaded-Relief Maps," Contributions to Geology, University of Wyoming, Vol. 30, No. 2, pp. 137-147.

Di, L., and **D.C. Rundquist**, "A One-Step Algorithm for Correction and Calibration of AVHRR Level 1B Data," Photogrammetric Engineering and Remote Sensing, Vol. 60, No. 2, February, pp. 165-171.

Di, L., **D.C. Rundquist** and L. Han, "Modelling Relationships Between NDVI and Precipitation During Vegetative Growth Cycles," International Journal of Remote Sensing, Vol. 15, No. 10, pp. 2121-2136.

Dillworth, M.E., J. Whistler and **J.W. Merchant**, "Measuring Landscape Structure Using Geographic and Geometric Windows, Photogrammetric Engineering and Remote Sensing, Vol. 60, No. 10, pp. 1215-1224.

Exner, M.E. and R.F. Spalding "N-15 Identification on Nonpoint Sources of Nitrate Contamination Beneath Cropland in the Nebraska Panhandle: Two Case Studies" Applied Geochemistry Vol. 9, pp. 73-81 (Journal Series No. 10485).

Feng, Z.D., W.C. Johnson, and **R.F. Diffendal, Jr.**, "Environments of Aeolian Deposition in South-Central Nebraska During the Last Clacial Maximum," Physical Geography, Vol. 15, No. 3, pp. 249-261.

Gosselin, D.C., J.F. Ayers, and Y-K Zhang, "Modeling Concentration Variation in High-Capacity Wells: Implications for Groundwater Sampling," Water Resources Bulletin, Vol. 30, No. 4, pp. 613-622.

Gosselin, D.C., S. Sibray and J. Ayers, "Geochemistry of K-Rich Alkaline Lakes, Western Sandhills, Nebraska, U.S.A." Geochimica Cosmochimica Acta, Vol. 58, No. 5, pp. 1403-1418.

Han, Luoheng and **D.C. Rundquist**, "The Response of Both Surface Reflectance and the Underwater Light Field to Various Levels of Suspended Sediments: Preliminary Results," Photogrammetric Engineering and Remote Sensing, Vol. 60, No. 12, pp. 1463-1471.

Han, L., **D.C. Rundquist**, L.L. Liu, R.N. Fraser and J.F. Shcalles, "The Spectral Responses of Algal Chlorophyll in Water with Varying Levels of Suspended Sediment," International Journal of Remote Sensing, Vol. 15, No. 18, pp. 3707-3718.

Kuzila, M.S. "Inherited Morphologies of Two Large Basins in Clay County, Nebraska," Great Plains Research 4, February, pp. 51-63.

Merchant, J.W., "GIS-Based Groundwater Pollution Hazard Assessment: A Critical Review of the DRASTIC Model," Photogrammetric Engineering and Remote Sensing, Vol. 60, No. 9, pp. 1117-1127.

Narayanan, R.M., D.W. Doerr and **D.C. Rundquist**, "Power Spectrum of Wind-Influenced Vegetation Backscatter at X-Band," IEEE Proceedings on Radar and Sonar Navigation, Vol. 141, No. 2, pp. 125-131.

Narayanan, R.M., R. Pardipuram and **D.C. Rundquist**, "Statistical Characteristics of Simulated Radar Imagery from Bare Soil Surfaces," IEEE Transactions on Geoscience and Remote Sensing, Vol. 32, No. 1, pp. 159-168.

Pederson, D.T., "An Economical Sampling Pump for Groundwater Investigations," Journal of Geological Education, Vol. 42, pp. 147-148

Prestegaard, K.L., **A.M. Matherne**, E.B. Shane, K. Houghton and M. Mcconnell, "Spatial Variations in the Magnitude of the 1993 Floods, Reccoon River Basin, Iowa," Geomorphology, Vol. 10, pp. 169-182.

Reed, B.C., J. Brown, D. VanderZee, T. Loveland, **J. Merchant** and D. Ohlen, "Measuring Phenological Variability from Satellite Imagery," Journal of Vegetation Science, Vol. 3, pp. 703-714.

Spalding, R.F., M.E. Burbach, **M.E. Exner**, L. Parra-Vicary and D.R. Alexander, "Sprinkler Irrigation: a VOC Remediation Alternative," Technology: Journal of the Franklin Institute, Vol. 331A, pp. 231-24

Books/Chapters in Books

Chen, X-H., H.P. Heasler and L.E. Borgman, "Geostatistical Methods for the Study of Pressure Compartments: A Case Study in the Hilight Oil Field, Powder River Basin, Wyoming, In Ortoleva, P.J., Ed., Basin Compartments and Seals, American Association of Petroleum Geologists Memoir 61, pp. 263-271.

Reed, B., T. Loveland, L. Steyaert, J. Brown, **J. Merchant** and D. Ohlen, "Designing Global Land Cover Databases to Maximize Utility: The U.S. Prototype, in Environmental Information Management and Analysis: Ecosystem to Global Scales, W. Michener and J. Brunt, eds., London: Taylor and Francis, pp. 303-318.

Proceedings

Chen, X-H., L.E. Borgman and P.J.S. Colberg, "Numerical Studies of Biodegradable and Nonbiodegradable Contaminant Transport in Heterogeneous Porous Media," Proceedings, 1994 Ground Water Modeling Conference, Fort Collins, CO, pp. 461-468.

Exner, M.E., "Source Identification of Nitrate Contamination in Shallow Ground Water in Nebraska, USA," in Water Down Under '94, Vol. 2, Part B, pp. 429-432.

Merchant, J.W., L. Yang and W. Yang, "Validation of Continental-Scale Land Cover Databases Derived from AVHRR Data," Proceedings of the PECORA Symposium, American Society for Photogrammetry and Remote Sensing.

Pabian, R. and D. Mosher, "An Immature Brachymetopid Trilobite from the Iowa Formation (Late Pennsylvanian-Missourian) Near Sand Springs, Tulsa County, OK," Proceedings, Nebraska Academy of Sciences, 114th Annual Meeting, p. 50.

Sibray, S.S., and Y-K Zhang, "Three-Dimensional Modeling of Hydraulic Behavior of a Highly Conductive Secondary Permeability Zone in the Brule Formation," Proceedings, Groundwater Modeling Conference.

Yang, W., L. Yang and **J. Merchant**, "AVHRR-Derived NDVA and Eco-climatological Parameters: Relationships, Spatial and Temporal Variabilities," Proceedings of the Annual ASPRS Convention, Amer. Society for Photogrammetry and Remote Sensing, pp. 744-755.

Maps

Merchant, J.W., "Seasonal Land Cover Regions of the United States," (co-authored with T.R. Loveland, et al), U.S. Geological Survey, Reston, VA, scale 1:7,500,000, prepared from satellite image analysis.

Swinehart, J.B., V.H. Dreeszen, G.M. Richmond, M.J. Tipton, R. Bretz, F.V. steece, G.R. Hallbert, J.E. Goebel and **V. Souders**, "Quaternary Geologic Map of the Platte River 4 degree x 6 degree Quadrangle, United States," Quaternary Geologic Atlas of the United States, G.M. Richmond, ed., Miscellaneous Investigations Series, Map I-1420, U.S. Geological Survey.

Published Abstracts

Carlson, M.P., "Effects of Reactivation of the North American Midcontinent Rift System on Phanerozoic Stratigraphy," Abstracts, 11th International Conference on Basement Tectonics, Potsdam, Germany.

Carlson, M.P. and D. Newell, "Stratigraphy and Petroleum Potential of the Simpson, Viola and Maquoketa in Kansas and Nebraska," Abstracts, Symposium on the Simpson and Viola Groups in the Southern Midcontinent, Norman, OK.

Chen, X-H., and L. Jayne, "Estimating Soil Air Permeability from Partially Penetrating Test Wells," Geological Society of America Abstracts with Program, Vol. 27, No. 7, p. 444.

Kuzila, M.S., M.C. Warner and R.K. Gunn, "The Implications of a Soil Survey Update on Land Management Activities", Abstracts, 49th Annual Meeting, Soil and Water Conservation Society, p. 35.

Loope, D.B., **J.B. Swinehart** and J.P. Mason, "Intrinsic vs. Climatic Controls on the Accumulation of Lake and Marsh Sediments, Nebraska Sand Hills," Abstracts with Programs, Geological Society of America Annual Meeting, p. A-303.

Matherne, A.M., Subsurface Topography: Controls on Groundwater Flowpaths and the Formation of Alkaline Wetlands," EOS, American Geophysical Union Fall Meeting.

Pederson, D.T., "The Role of Semi-Perched Groundwater in a Developed Regional Aquifer in Nebraska," Transactions, American Geophysical Union, Vol. 75, No. 44, p. 249.

Ponte, M.R., D.B. Loope and **J.B. Swinehart**, "Significance of Interbedded Eolian Sand and Peat Beneath Interdunes of the Central Nebraska Sand Hills," Abstracts with Programs, Geological Society of America Annual Meeting, p. A-62.

Prestegaard, K.L., E.B. Shane, **A.M. Matherne**, K.K. Houghton and M.E. O'Connell, "Possible Causes of Variations in Flood Magnitude: The Floods in the Raccoon River Basin, Iowa," Abstracts with Programs, Geological Society of America, p. A-235.

Srivastav, P. and **D. T. Pederson**, "Wetland Hydrology: Spatial and Temporal Variations Within a Wetland in a Controlled Field Setting," Abstracts with Programs, Geological Society of America, Vol. 26, No. 7, p. A-410.

Wang, Z., and **X-H. Chen**, "Application of Numerical Models for Adjusting a Remediation System in a Complex Recharge Site," Abstract, 7th Annual Meeting of American Water Resources Assoc., Wyoming State Section.

Research/Contract Reports

Exner, M.E. "Assessment of Pesticide Occurrence in Nebraska Ground Water," Water Sciences Laboratory, Water Center contract report for the Nebraska Department of Agriculture, 50 pp.

Exner, M.E., "Pesticide Monitoring Strategy for the State Management Plan," Water Sciences Laboratory, Water Center contract report for the Nebraska Department of Agriculture, 29 pp.

Goeke, J., A. Matherne and D. Gosselin, "Hydrogeologic Dynamics of the Wet and Dry Valleys at the Gudmundsen Sandhills Research Laboratory," WCC 94-01, Gudmundsen Sandhills Laboratory Research Report 1991-1994, pp. 51-52.

Matherne, A.M., R.R. Burchett, J.A. Ayers and L. Howard, "GIS Database and Assessment of the Physical Natural Resources of the Cedar River Basin, Nebraska," Contract Report.

Miscellaneous/Other

Merchant, J.W., Articles on "Remote Sensing and Aerial Survey" for Encarta Encyclopedia CD-ROM, Redmond, WA: Microsoft, Inc.

Merchant, J.W., Book Review, "Landscape Ecology and GIS," Professional Geographer, Vol. 46, No. 4, pp. 516-617.

Merchant, J.W., "Geographic Information Systems: Some Sources of Information" in The GIS Applications Book: Examples in Natural Resources - A Compendium, W. Ripple, ed., Bethesda, MD: American Society for Photogrammetry and Remote Sensing, pp. 367-362.

Pabian, R. and M.R. Bolick, "The Abominable Mystery of the First Flowers: Clues from Nebraska and Kansas," Museum Notes, University of Nebraska State Museum, No. 88, 6 pp.

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TO DATE

Refereed Journals

Ayers, J.F. and **D.C. Gosselin**, "Design of a Multi-Level Sampling System for Continuous Sample Collection," Ground Water Monitoring and Remediation, Vol. 15, No. 3. (In Press)

Ayers, J.F., "Synthetic Seismogram Generation for Designing Shallow Seismic Surveys," Journal of Environmental and Engineering Geophysics. (Accepted)

Davis, R.K. and **D.T. Pederson**, "Patterns of Ground-water Level Decline in Developed Acuifers," American Water Resources Association Water Resources Bulletin. (Accepted for Publication)

Goodin, D.G., J.A. Harrington, M.D. Nellis and **D.C. Rundquist**, "Mapping Reservoir Turbidity Patterns Using SPOT-HRV Data," GeoCarto International. (In Review)

Gosselin, D.C., J.L. Wright, **A.M. Matherne, D.R. Mohlman** and **F.V. Belohlavy**, "The Nebraska Earth Science Education Network Initiative," Journal of Geological Education, Vol. 43, pp. 26-29.

Kuzila, M.S., "Identification of Multiple Loess Units Within Modern Soils of Clay County, Nebraska," in Geoderma, International Journal of Soil Science, Vol. 65, pp. 45-57.

Lodhi, M. **D.C. Rundquist**, L. Han and **M. Kuzila**, "Spectral Reflectance from Two Loess soils in Suspension," Water Resources Bulletin. (In Review)

Loveland, T.R., **J.W. Merchant**, J.F. brown, D.O. Ohlen, B. Reed and P. Olsen, "Seasonal Land Cover Regions of the United States," Annals of the Association of American Geographers. (In Press)

Loope, D.B., **J.B. Swinehart** and J.P. Mason, "Dune-dammed Paleovalleys of the Nebraska Sand Hills: Intrinsic Versus Climatic Controls on the Accumulation of Lake and Marsh Sediments, GSA Bulletin, Vol. 107, No. 4, pp. 396-406.

Pabian, R.K. R. Lewis, and P. Holterhoff, "A Crinoid Lagerstatten from the Late Pennsylvanian of Northeastern Oklahoma," National Geographic Society. (In Press)

Price, K.P., V. Varner, E.A. Martinko and **D.C. Rundquist**, "Influences of Land Management on Hyperspectral Responses from Vegetation," Remote Sensing of environment. (In Review)

Rundquist, D.C., B.L. Leavitt and S. Payton, "ERS-1 Backscatter from Submerged Aquatic Vegetation in Shallow Lakes," International Journal of Remote Sensing. (In Review)

Rundquist, D.C., L. Han, J.F. Schalles and J.S. Peake, "Remote Measurement of Algal Chlorophyll in Surface Waters: The Case for the First Derivative of Reflectance Near 690 nm," Photogrammetric Engineering and Remote Sensing. (In Press)

Rundquist, D.C., J.F. Schalles and J.S. Peake, "The Response of Volume Reflectance to Manipulated Chlorophyll Concentrations Above Bright and Dark Bottoms at Various Depths in Experimental Tanks," GeoCarto International. (In Press)

Sherler, K.E., **D.C. Rundquist**, and H.J. Gilgen, "Inventory of Glaciers," Chapter 15 in Satellite Image Atlas of Glaciers, U.S. Geological Survey Professional Paper 1386. (In Press)

Tabidian, A.M. and **D.T. Pederson**, "Impact of Irrigation Wells on Baseflow of the Big Blue River, Nebraska," Water Resources Bulletin, Vol. 31, No. 2, pp. 295-306.

Tolk, B., **D.C. Rundquist**, and L. Han, "Bottom Color and the Upwelling Spectral Signal from Water at Various Suspended-Sediment Concentrations," Photogrammetric Engineering and Remote Sensing. (In Review)

Verstraeten, I.M., **S.S. Sibray**, J.C. Cannia and D.Q. Tanner, "Reconnaissance of Groundwater Quality in the North Platte Natural Resources District, Western Nebraska," U.S. Geological Survey Water-Resources Investigations, Report 94-4057.

Zlotnik, M.E. Burbach, **M. E. Exner (Spalding)**, and R.F. Spalding, "Well Sampling for Agrichemicals in High Capacity Systems," Journal of Soil and Water Conservation, Vol. 50, No. 1, pp. 95-101.

Books/Chapters in Books

Tedford, R.H., **J.B. Swinehart**, C.C. Swisler III, D.R. Prothero, S.A. King and T.E. Tierney, "The Whitmey-Arikareean Transition in the High Plains," in The Terrestrial Eocene-Oligocene Transition in North America, D.R. Prothero and R.R. Emery, eds, Cambridge Unviersity Press. (In Press)

Proceedings

Gosselin, D.C., J.F. Ayers and J. Guretsky, "Sampling Dynamics of Irrigation Wells," Proceedings, Conference on Clean Water - Clean Environment in the 21st Century, ASAE, St. Joseph, MI, pp. 113-116.

Price, K.P., V.C. Varner, E.A. Martinko, **D.C. Rundquist** and J.S. Peake, "Use of Multitemporal and Hyperspectral Measurements to Discriminate Among Six Management Practices on Prairie Types in Kansas," Proceedings, American Society for Photogrammetry and Remote Sensing. (In Press)

Srivastav, P. and **D.T. Pederson**, "Wetland Hydrology: Spatial and Temporal Variations Within a Wetland in a Controlled Field Setting," Proceedings of the Nebraska Academy of Sciences, p. 56.

Maps

Swinehart, J.B. and **R.F. Diffendal, Jr.**, "Geologic Map of Morrill County," 1:62:500, U.S. Geological Survey Miscellaneous Investigations Series, Map I-12496. (In Press)

Swinehart, J.B. and **R.F. Diffendal, Jr.**, "Geologic Map of the Scottsbluff 1 x 2 degree Quadrangle, Nebraska and Colorado," U.S. Geological Survey Miscellaneous Investigations Series, Map I-12545. (In Press)

Published Abstracts

Chen, X-H., "Using Numerical Models for the Design of a Soil-Venting System in a Hydrocarson-Contaminated Site," Geological Society of America North-Central and South-Central Sections, Abstracts with Program, Vol. 27, No. 3, p. 43.

Chen, X-H., and D.W. Boyd, "Marine Fossils from Permian Redbedds (Satanka Shale) at Laramie, Wyoming," Contributions to Geology, University of Wyoming. (In Press)

Gosselin, D.C. and **D.C. Rundquist**, "The Western Lakes Project: Multidisciplinary Investigations of Hydrologically Dynamic Fresh to Saline Lakes of Nebraska," Abstracts with Program, North-Central and South-Central Sections, Geological Society of America Meeting, Vol. 27, No. 3, P. 52.

Khisty, M.J., **D.C. Gosselin** and **D.C. Rundquist**, "Characterizing a Groundwater-Lake System in the Nebraska Sandhills Using a Mass Balance Approach," Abstract with Program, North-Central and South-Central Sections, Geological Society of America Meeting, Vol. 27, No. 3, p. 64.

Pabian, R.K., D. Mosher, P. Holterhoff and R. Lewis, "Crinoid Assemblage from the Barnsdall Formation, Late Pennsylvanian (Missourian) Washington County, Oklahoma," Abstracts with Program, Geological Society of America Meeting, Vol. 27, No. 3, p. 78.

Pederson, D.T., "Is Water Management of the High Plains Aquifer Based on Inadequate Conceptual Models of Hydrogeology?" Abstracts with Program, North-Central and South-Central Sections, Geological Society of America, Vol. 27, No. 3, p. 79.

Pederson, D.T., "Interpretation of Water-Level Declines in a Developed Regional Aquifer for Management of the Resource," Abstract in Proceedings, AWRA Symposium, Water Resources and Environmental Hazards: Emphasis on Hydrologic and Cultural Insight in the Pacific Rim. (In Press)

(Spalding) Exner, M.E., "Update on the Occurrence of Pesticides in Nebraska Ground Water," Geological Society of America North-Central and South-Central Sections, Abstracts with Program, Vol. 27, No. 3, p. 49.